Evaluation of a school-based nutrition and food preparation skills intervention delivered to schoolchildren from deprived social backgrounds

The efficacy of a school-based nutrition and food preparation skills intervention delivered as an after-school 'Food Club' to children aged 11-13 years living in socially deprived areas of Tyne and Wear

A thesis submitted in partial fulfilment of the requirements of the University of Newcastle for the degree of Doctor of Philosophy

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Certificate of Originality

This is to certify that I am responsible for the work submitted in this thesis, that the original work is my own except as specified in acknowledgements or footnotes and that neither the thesis nor the original work contained therein has previously been submitted to any institution for a higher degree.

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Abstract

Changes to the Technology content of the National Curriculum means that the teaching of cooking skills at secondary school is decreasing to make room for the delivery of the industrial design process. The impact of the decline in the teaching of cooking skills to children in school is likely to be greater upon lower income groups who consume the poorest quality diet.

This controlled study evaluated the impact upon the intake of foods and nutrients of socially deprived children aged 11-13-years-old, following attendance to a dietary intervention delivered in the form of an after-school Food Club. The Food Club aimed to teach cooking skills using inexpensive, healthful ingredients and basic equipment.

Ten secondary schools (five intervention group, five control) in Tyne and Wear were recruited and 167 children completed two 3-day food records and a nutrition knowledge questionnaire at baseline and post-intervention. Children in the intervention group only were invited to attend twenty Food Club sessions. It was found that:

- **The Food Club did not impact upon nutrient intake in children in the intervention group above that of the control**
- **The Food Club did have a positive impact upon the intake of fruit and vegetables of boys in the intervention group**
- **The percentage of energy derived from non-milk extrinsic sugars exceeded the current UK DRV at 18% at baseline and 15% at post-intervention**
- **Non-diet carbonated soft drinks accounted for between 8-11% of MEI**

It is concluded that whilst the Food Club did not impact upon the diets of the children it did have a positive effect upon fruit and vegetable intake in boys. The teaching of food and specifically cooking skills in the National Curriculum appears to have an insecure future. Extra-curricular Food Clubs can contribute to the public health initiative to address inequality of diet.

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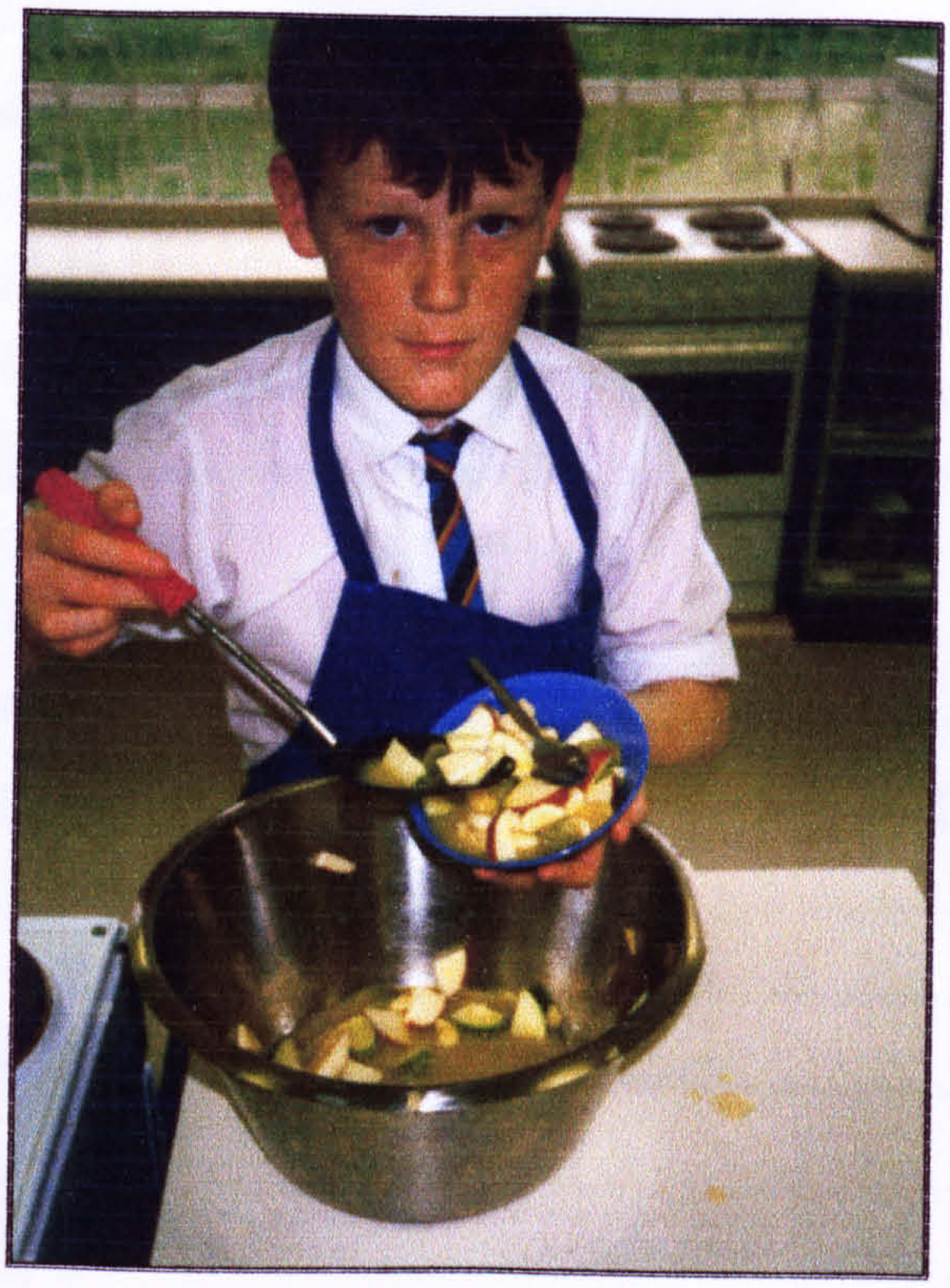
Plate 1.1 Making fruit salad at the Food Club



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"How can youngsters learn about food and healthy eating if they are not shown how to prepare food? If you can't cook, you are putting your nutrition in the hands of the manufacturers of ready-made meals. We need to engage our young people in a culinary culture and show them that cooking is fun".

Anita Cormac, Director; Royal Society of Arts Focus on Food campaign.
(Burger Battles, *Guardian Education*, Tuesday May 23 2000, page 2)

Figure 1-1 The National Curriculum: Subjects and Key Stages*

	Key stage 1	Key stage 2	Key stage 3	Key stage 4	
Age	5–7	7–11	11–14	14–16	
Year groups	1–2	3–6	7–9	10–11	
English	■	■	■	■	National Curriculum core subjects
Mathematics	■	■	■	●	
Science	■	■	■	●	
Design and technology	■	■	■	●	National Curriculum non-core foundation subjects
Information and communication technology	■	■	■	■	
History	■	■	■		
Geography	■	■	■		
Modern foreign languages			■	●	
Art and design	■	■	■		
Music	■	■	■		
Physical education	■	■	■	●	
Citizenship			▶	▶	

■ Statutory from August 2000
● Statutory from August 2001
▶ Statutory from August 2002

* Taken from: The National Curriculum On-Line [http://www.nc.uk.net/subject_key]
How the National Curriculum Works

In order to eat a healthy diet it is necessary to have some understanding of what comprises a healthy diet. The public are informed through various agencies, government bodies and health professionals that a healthy, balanced diet is key to maintaining good health, reducing the risk of diet-related diseases and minimising susceptibility to infection and ill health. In order to meet current dietary guidelines, a basic level of knowledge of food, nutrition and food preparation is surely a requirement.

Social changes, particularly in the nations' working lifestyle have had an impact upon family life in the United Kingdom. The need and indeed the desire for parents, particularly mothers, to work outside the family home has increased. The traditional role of the housewife and mother changed rapidly throughout the last quarter of the 20th century and the rate of change continues to accelerate in the 21st. Such change in the roles of the sexes in society has been reflected in education and the curriculum in UK schools. The teaching of home economics and domestic skills was predominantly considered a female requirement, that is, girls at secondary school level were taught cooking and domestic skills under the subject of either domestic science or home economics. Home economics were taught to girls to prepare them for an adult life with a domestic focus.

Progressively more schools chose to teach cookery and domestic science to boys during the 1970's and the 1980's until it became the norm in most state schools in the UK. The introduction of the National Curriculum (National Curriculum, DfES, 1999) sought to reduce educational inequalities between not only schools and local authorities, but between the social classes and the sexes. Many subjects that were traditionally taught to one sex only were seen to be equally necessary to boys and girls, although along with home economics other subjects such as sciences, technology and information and communication technology were included in this curriculum shift. Having emerged in the early 1970's as an independent subject, home economics and its delivery in the form of cookery classes in secondary schools, had sought to equip young people with the theoretical knowledge and accompanying practical skills to allow them to shop, prepare and cook a wide range of meals. However, it appears that opinion inclined towards assuming that needs differed between the sexes and the social classes.

The removal of this assumption in the late 1970's and subsequent educational provision allowed, until recent changes in the National Curriculum commencing in the early in the

1990's, the teaching of food and cooking skills to all young people of secondary school age. Alas, good intentions were compromised in order to make room for progress.

Both the value and reliance upon food knowledge and practical cooking skills acquired in school by young men and women is well documented and presented by Lang and colleagues in a review of cooking skills and health commissioned by the Health Education Authority (Lang *et al*, 1999). In a further analysis of the Health Education Authority's 1993 Health and Lifestyles Survey data, Lang *et al* studied the responses of 5,553 (2,826 females, 2,727 males) people who took part in the original survey, selecting data relevant to the knowledge of food and nutrition and of cooking skills. Respondents were asked how they had learned to cook. In response to this question, 58% of males and 76% of women had first learnt to cook with their mother. Forty nine percent of women and 15% of men responded that they had also first learnt to cook from cookery classes at school.

When performing the analysis by social class, the importance of school cookery classes was even more apparent. Within the lower social classes, first learning to cook at school was significantly more important ($P<0.001$) in the social groups IV and V (38% and 35% respectively) than in the higher social groups (group I: 11%, group II: 25%). The lower social groups relied much less upon cookery books, cookery programmes on television, cookery articles in magazines and partners or spouses. The differences between the social groups in these sources of learning were found to be significant at $P<0.001$. Additionally, younger males (aged between 16 and 35) were also significantly more likely to have first learnt to cook from cookery classes at school than older males (those aged 35 to 74). This is one outcome of the analysis that serves to highlight the recent benefit of teaching cooking skills to boys at school as well as girls, which has likely arisen from the National Curriculum. Older males, however, were significantly less likely to have learnt from their mothers ($P<0.001$), which is perhaps more a reflection of social perceptions of domestic and cooking skills during youth, i.e., it is probable that there was less of need for young males to learn to cook when it was assumed this would be the role of mothers and wives.

Since the evidence presented by Lang *et al* suggests that school cookery classes are a fundamental source of learning about food and developing skills, then surely this presents a strong argument for preserving the teaching of cookery to all young people, regardless of social class or sex. Apparently, in view of recent curriculum changes in the teaching of food, this would not appear to be the case.

Food is no longer taught as Home Economics in state schools. It is still taught, however, at many independent, selective schools (Design and Technology Association, 2001). The subject of Home Economics currently includes a major element of the teaching of cooking skills, budgeting, meal planning and shopping and does not include recognisable aspects of technology as included in the Food Technology curriculum (personal communication, Design and Technology Association, June 2001). In June 2000, 34,500 pupils were entered for examinations in GCSE Home Economics. It is reasonable to suggest that socially deprived children are not in a position to benefit from the largely practical food preparation and cooking skills taught in Home Economics lessons at independent schools.

The teaching of food and nutrition in English and Welsh state schools are delivered in accordance to the National Curriculum for England and Wales (Section 12.1 National Curriculum for England: Design and Technology). At primary school level food and nutrition may be incorporated into any subject as a teaching tool but features most frequently in science, technology and personal, social and health education (PHSE). Guidelines on the inclusion of information on food and nutrition in primary teacher training courses have previously been developed by MAFF with the assistance of the British Nutrition Foundation (DoH & MAFF, 1998). The document was designed specifically to address the content and need for education and training in food and nutrition for both trainee and qualified primary school teachers.

Design and Technology is a non-core foundation subject at Key Stage 1 (age 5-7 years), Key Stage 2 (age 7-11 years) and Key Stage 3 (age 11-14 years). In August 2002, Technology became a core subject (along with mathematics, English and science). Food may or may not, however, be included as a material within Design and Technology. At secondary school level food is not an independent curriculum subject as such – currently it falls under the 'umbrella' of technology in the form of Food Technology. Food Technology is often one of as many as five subjects taught within the Technology framework. Other subjects include resistant materials, textile technology, graphic products, systems and control and electronic products, (National Curriculum 2000).

The time allocated to food technology will be shared alongside this range of subjects but in real terms will be at the discretion of the Head of Technology in each school and subsequently the Head of Food Technology. Food technology is commonly taught by a teacher with specialist subject knowledge of food, nutrition and food technology. However, in some schools, in order for food technology to be offered at all, it may be taught by a teacher whose specialist subject is design technology.

Under the umbrella of technology, it cannot be dismissed that the presence of food in the curriculum is preferable to its absence, but the content of the food curriculum has shifted away from acquiring skills in budgeting, shopping and cooking, towards industrial scale food production. Food and nutrition have become 'Food Technology', cooking skills are now called 'making skills' and even the humble ingredient is no longer – it is now purely a 'component' required in the manufacture of a food product. The curriculum now embraces food packaging technology, labelling requirements and new product development. There is also some obsession with 'ready-to-eat' products and how this is at all useful in learning how to put a meal together is not entirely comprehensible. All this may be extremely relevant the food manufacturing industry as it exists today (the largest manufacturing industry in the UK). It would appear that learning about food is now more about reading a label, designing a package, developing a product, putting a product on a supermarket shelf and marketing that product than it is about having the ability to prepare a cook a healthy meal for oneself.

It is apparent that there are many excellent teachers of food technology who strive to teach sound cooking skills to their pupils. Evidence of this exists in many in grey literature publications. Many Food Technology teachers will likely have qualified and started teaching before the larger curriculum changes in the 1990's and still value the teaching and developing of cooking skills and sound nutrition knowledge and who are determined to include them in the teaching of food at Key Stage 3. However, there is currently a shortage of teachers who are food subject specialists and qualified to teach Food Technology (Jenny Jupe of DESIGN AND TECHNOLOGY ASSOCIATION, 2001, personal communication). Many schools (an estimate of 95 % of UK schools by Valentine, 2000), still endeavour to include food in the technology curriculum. The reality of food lessons is less generous, however. Ballam (2000) reports that on average UK schools devote 26 lessons per year to food. Of these 26 lessons, over 50% are devoted to 'practical' work. Overall, this may be calculated to be between 26 hours and 13 hours, depending on the length of lesson periods in individual schools. Therefore, if Ballam is correct, approximately 6.5 to 13 hours are spent *per year* on lessons with a practical focus. It can only be estimated as to how much in the way of practical skills can be passed from teacher to pupil within a time period of 6.5 to 13 hours. Since any practical lesson must involve a demonstration, the supervision of the pupils whilst they cook and a great deal of cleaning up there a few dishes that can be cooked within a typical hour-long lesson. It must also amount to extreme pressure on the part of food teachers to impart even the most simple of cooking techniques to pupils within this space of time.

When pupils are selecting those subjects they wish to pursue for state examinations at age 16 years (commonly the General Certificate of Secondary Education [GCSE]) technology is a compulsory subject and must be studied even if the pupil does not sit formal examinations. Indications are that Food Technology remains a highly popular subject at Key Stage 4 – in June 2000 106,650 pupils in England and Wales were entered for GCSE Food Technology state examinations (Design and Technology Association, 2001). This is some 27% of the 396,567 pupils sitting Design and Technology examinations.

Several recent surveys of schoolchildren have indicated a poor state of knowledge concerning food. Notably, a survey of 9 year old children (n = 256) conducted by the British Potato Council in found that 48% thought that potatoes grew on trees and bushes (British Potato Council, 2000). Watt & Sheilham (1996) report that inner city children were five times more likely to read the sell-by date on a food label than to read the nutrition information. However, perhaps this should not be so surprising when there appear to be discernible differences in the curriculum as it is taught at Key Stage 3 (DfES, 2002) and at Key Stage 4 at G.C.S.E level (Oxford Cambridge and RSA Examinations, 2000). Younger children are required to focus on the 'design and make' assignment, whilst G.C.S.E Food Technology students may at least be afforded the opportunity to study required compulsory components such as nutrition and exploration of food commodities.

The role of schools in providing nutrition and food education is highlighted in the 1996 Department of Health report; *Low Income, Food, Nutrition and Health: Strategies for Improvement.* The position of the Department of Education and Skills is defined as maintaining a place for the teaching of food and nutrition within the national curriculum, on the basis that education to age 16 years is accessible to all, regardless of social class and income. It is proposed within this document that the greatest benefit will be to those on low incomes, in terms of both short-term and long-term health.

The various legislative changes in curriculum focus and content during the past two decades have reduced the ability of schools to teach young people aged 11-16 years about food, nutrition and healthy eating behaviour (Bowker *et al*, 1999). The Department of Health (1996) identified schools as a suitable place for the teaching of cooking and budgeting skills. However, this move has not been entirely supported by current curriculum changes effected and supported by the Department for Education and Skills concerning the practical element of Food Technology lessons.

The greatest potential effect of teaching cooking skills are likely to be in those areas where low income and the quality of diet are likely to have an adverse effect on health. This is an issue that receives a great deal of support. The view that cooking, shopping and budgeting skills should be taught within school currently receives a great deal of support (Stitt, 1996, National Food Alliance, 1997).

Bowker *et al* (1999) refer to the recent changes in the curriculum as having 'affected the development of skills relating to food and nutrition' and that presently in schools ' there is limited time available to teach home economics'. Nutritionists and health professionals have voiced concern over the shift of emphasis away from practical food preparation skills, to the teaching of food under the broad umbrella of technology. Whilst nutrition is gradually becoming incorporated into the compulsory health education curriculum, at present only guidelines not statute exist.

Stitt (1996) considers food provision within the curriculum in England and Wales inadequate compared to other European nations and strongly advocates that the teaching of food education in the UK begins at age 5 and continues until age 16. Valentine (2000) describes the opportunity for the teaching of food and nutrition not solely in technology, but within science and personal, health and social education (PHSE). Dixey (1996) praises nutrition education within PHSE for addressing 'societies pressures' upon young people to concentrate on image rather than health and for providing an opportunity to promote a positive body image.

Ballam (2000) attempts to present us with a more optimistic view of the teaching of cooking skills in schools. When Ballam's findings transcribe as at maximum of 13 per year, its true value (barely adequate) becomes apparent. Valentine (2000) indicates that food technology is currently taught in 95 per cent of schools and that GCSE Food Technology is growing in popularity but does not quantify this statement. Ballam (2000) does acknowledge lessons are not long enough and qualifies this acknowledgement with the survey findings that many secondary school teachers have to deliver a practical food lesson within a 50-minute period.

It is reasonable to suggest that only those recipes that can be prepared and cooked within this time period will be included in lessons. This emphasises the need for some depth of knowledge on food preparation and cooking skills on the part of the food technology teacher and good judgement of the practical abilities of the children in the class.

Addressing the concept of technology in food, Ballam suggests that pupils need to acquire 'a questioning approach to how their food is prepared'. This in itself suggests a passive relationship with food and that schoolchildren are becoming accustomed to eating more convenience products rather than foods that either they have prepared or have observed being prepared for example within the family home. It also suggests that the future of food knowledge will lend itself more to making informed choices as a consumer, i.e. being able to read the sell-by date on food labels (Watt & Sheilham, 1996), than to being able to prepare a healthy meal.

In order to properly identify the needs of the nation regarding effective learning about food, nutrition and cooking skills and how this may impact on quality of diet and upon health, it is necessary to assimilate all appropriate data available and subjectively identify useful and workable strategies to safeguard the teaching of food and cooking skills to young people in the UK. In terms of the National Curriculum, it is necessary to evaluate the recent changes and their potential to impact on public health. However, at the present time it would seem evident that a strategy, both useful and workable, was already in place in the teaching of food, nutrition and cooking skills in secondary schools throughout the UK, to all classes and sexes and that the power and value of this strategy has now been undermined and discarded.

2 Review of literature on diet, cooking skills and social deprivation

"Cooking skills education could play a useful part in generating a common food culture rather than reflecting a divided food culture. General food skills, not just cooking, such as handling techniques, hygiene, shopping and storage knowledge, could be seen as part of life skills and an important part of any citizen's education. Questions are also raised about when is the best time to learn to cook and to foster confidence without which healthy choices cannot be made. There appear to be three phases in which people learn to cook: basic experimentation in the home, from an early age; then formally at school; and finally when living independently away from home. The removal of the second phase under the reform of the national curriculum has implications for the nation's future skills base".

Lang *et al* (1999) Cooking Skills and Health. London: HEA

"Parents should ask, not just whether their child can read and write and cross the road safely, but whether the child is learning to take control of their daily food. A culture whose people cannot cook is a much impoverished culture"

David Blunkett MP, (June 1993)

"the development of practical food preparation skills by children is vital to the long term health of the UK"

Department of Health (1996) Eat Well II:A progress report from the Nutrition Task Force on the action plan to achieve the Health of the Nation targets on diet and nutrition. London:HMSO

The last two decades have produced a wealth of literature concerning health inequalities in the United Kingdom. Much of the literature serves to highlight the widening gap between affluence and poverty and both the causative and consequential effect of chronic diseases upon public health. Diet is just one aspect of many within health inequalities. A healthy diet is important in protecting and maintaining good health but it is recognised that those with low incomes have the poorest quality diet which does little to protect against those diet-related factors associated with chronic diseases in adult life.

Food choice and the quality of diet in adult life may be restricted as a result of one or many factors. These may include poor knowledge of the nutritional value of foods, low income, restricted access to a variety of foods (Ellaway & Macintyre, 2000, Donkin *et al*, 1999), and limited food preparation and cooking skills (Anderson & Morris, 2000). It is widely accepted that eating behaviour, habits and attitude towards consuming a healthy diet are formed largely in childhood (Lifshitz *et al*, 1993). Appropriate and adequate nutrition education during childhood and adolescence, in addition to the teaching of food preparation skills, may empower individuals to make beneficial food choices.

Several lifestyle-related factors, such as diet, physical activity, smoking and alcohol use are implicated in the risk of chronic diseases such as coronary heart disease (CHD), late onset diabetes and cancer (e.g. cancer of the stomach, bowel and breast) (Wheelock, 1992, WHO, 1990). Diets that are high in non-milk extrinsic sugars and where intakes of sugary and acidic foods are frequent, have the potential to impact upon dental health in infancy, childhood and beyond (Rugg-Gunn, 1993[b]). In particular, diet is known to have a great influence on the aetiology and control of dental caries. A diet that is high in fat (also saturated fat) and sodium, and low in fibre, fruits and vegetables has been associated with an increase risk and incidence of (and higher mortality from) cardiovascular diseases (COMA, 1994), some cancers (WHO, 1990) and stroke (Gariballa, 2000). Socio-economic factors have been also been related to caries prevalence. Localised studies in England and Scotland have found that children from areas of greatest material and social deprivation had the poorest dental health and a greater experience of tooth ache and caries (Sweeney *et al*, 1995). Children in the lower social classes have higher levels of dental disease than those from the higher social groups. When additional compounding factors are considered, such as families in receipt of state benefits and lone parent families, the prevalence of dental disease increases significantly.

Other dietary factors implicated in stroke are sodium intake (associated with hypertension) and elevated homocysteine levels resulting from inadequate intake of folate, vitamin B_6 and vitamin B_{12} (Gariballa, 2000). Limited intakes of fruits of vegetables with corresponding low intakes of antioxidant vitamins, such as vitamins C, E, and A, reduce the protection afforded from free radical induced damage, which has been linked to the pathogenesis of CHD (National Heart Forum, 1997). An epidemiological study conducted by Acheson & Williams (1983) suggested that the incidence of stroke and ischaemic heart disease is greater in regions where consumption of fruits and vegetables are lowest.

2.1 Social deprivation, diet and health

In 1988 the 'Independent Inquiry into Inequalities in Health' (The Acheson report) was published. The function of the report was to review the state of knowledge and evidence concerning health inequalities in the UK, in order to prioritise policy options to reduce the burden of disease and to develop a strategy for enhanced public health. Several areas were identified as having a major impact upon health; those of relevance to this discussion are poverty, income, education and nutrition. Nutritional recommendations laid down in the report pertain mainly to those on low income and to mothers and children. Policy implications reside with the recognition that a healthy diet at an affordable price should be accessible to all, regardless of income.

Income inequalities impact upon quality of life and life expectancy. Socioeconomic status may impact upon the experience and duration of disability in old age (Melzer *et al*, 2000) and upon population mortality. Shaw *et al* (2000) attribute 24 per cent of all deaths of 15-64 year olds occurring between 1994-1997 in England, Wales and Scotland to unfavourable socioeconomic circumstances, (i.e. deaths that would not have occurred had the mortality rates of the least deprived population decile applied on a national level). Stanistreet *et al* (1999) report on a cross-sectional study using mortality data, Census data and New Earnings Survey data for 366 English local government districts to examine the relationship between income, income inequality (using an income inequality index) and mortality. A significant association was found to exist between both income and income inequality and standard mortality ratios ($P<0.001$).

Health status may also be affected by regional and local influences. There may already be sufficient evidence to suggest that district and postcode can be used to estimate household income and to accurately predict the social class of individuals (Danesh *et al*, 1999). Postcodes may provide a useful and reliable estimate of social class that could prove valuable in epidemiological studies, particularly where the association between poverty, income level and predisposition to disease are investigated.

Kinra *et al* (2000) report higher rates of obesity in girls and boys with increasing social deprivation. The incidence of obesity in socially deprived children increases significantly with age and Kinra *et al* conclude that such a high prevalence of obesity may contribute to the predisposition to greater morbidity late in life.

In terms of public health, social deprivation is now a potential determinant of health status that can no longer be disregarded by health professionals. Phillimore *et al* (1994) strongly support the use of a deprivation indices that can provide a tool within public health research for linking mortality patterns with material conditions and environment (i.e. deprivation and affluence) and not solely individual-specific health related behaviours. This suggestion is supported by Davey-Smith & Brunner (1997) who state the level of inequality in material sources to be a fundamental cause of socioeconomic differentials in health in the UK. Davey-Smith & Brunner report the UK to be second only to the United States in terms of being the most unequal developed nation.

In the White Paper 'Our Healthier Nation' it is stated that a healthy diet is important in maintaining and protecting health and it is recognised that those people with low disposable income are eating the poorest quality diet. In addition, it is recognised that the gap between the poor and the affluent in the UK is widening and that this contributes to the inequality of health and to the nutritional quality of diets. Whilst the government has stated a commitment to reducing dietary inequalities a cost effective means of improving the diets of those on a low income has yet to be formally identified.

In Britain, one in three children under the age of 16 now lives in poverty. Furthermore, low income and poor nutrition are connected at all stages of life during and beyond childhood, a phenomena Nelson (2000) terms 'nutritional poverty'. The consequences of inadequate nutrition in childhood are associated with poor growth, compromised immune function, poorer cognitive function and inferior educational attainment. Low income, or a fall in income, may have a direct negative effect upon food purchase and dietary choice, thereby reducing the nutritional quality of the diet (Anderson & Morris, 2000).

The relationship between poor diet and low income (National Food Alliance, 1997), unemployment (Gibney & Lee, 1993), and lone parenthood (Moynihan *et al*, 1993), most likely arises from the increasing cost of a healthy diet. Davey-Smith & Brunner (1997) report that the dietary requirements of the poorest 25 per cent of households cannot be currently met and cite the findings of Nelson (2000) that current benefit levels are failing in terms of enabling recipients to purchase a nutritionally adequate diet. The National Food Survey 2000 (DEFRA, 2000) found that that households in which the head of household was receiving less than £180 per week spent just £14.99 per person per week on food and drink. This is some 15% less than the average expenditure per person over all households in Great Britain. Additionally, these lower-income households were found to be consuming more fats and oils, eggs, sugar and preserves, bread, fresh potatoes, frozen and canned vegetables, wholemilk and beverages than the average for all households. The average consumption of fish, fruit juices, breakfast cereals, skimmed milk and cheese in households of low income (£180 per week) was lower than the average. The National Food Survey 2000 also found that households with children spent 20% per person on food and drink and 20% less on fresh fruit, fresh potatoes and vegetables, brown and wholemeal bread, cheese, carcass meat, fish and eggs. Households with children spent more than the average household on soft drinks. This suggests that possibly the price of certain food and beverages items may be having a prohibitive effect upon the food purchasing of families with low incomes and those with children. Direct interpretation of this data is risky because more than one factor may influence the food purchasing of any one household. It is too easy to suggest that having children in the household means that quality of food purchases may decrease. Household food expenditure may be affected by a reduced income from one adult in the household (directly related to caring for children in the home). Also, some economy of scale may occur in food purchase in addition to reduced food wastage.

In 1995 the Food Commission conducted a survey of eight nation-wide supermarkets to compare the cost of a healthy food basket to a less healthy basket. Lobstein (1995) reports that all pricing factors compound in raising the cost of healthy foods. Furthermore, the cost of a healthy shopping basket was reported to have increased by 31% in five years, compared to a much smaller 13% increase a basket of less healthy foods. Morris *et al* (2000) present an intriguing perspective of the standard of living that may be expected or accomplished for those individuals earning the minimum wage. Morris and colleagues attempt to assess a representative minimal living costs for a healthy, single man aged 18-30 years in full time employment. It was estimated that by earning the UK minimal wage for a typical 38 hour week, a wage of £121.12 (after statutory deductions) could be expected. The corresponding social security benefit for a single person were between £40.70 - £51.40 per week at the time of publication in 2000. A weekly food shop that corresponded to current dietary guidelines (including 400g of fruit and vegetables per day) for an adult male would cost approximately £32.00. In effect it means that the working single person in the UK would have to spend a quarter of his wage on food, in order to meet the recommendations. For those not in employment, between 62 and 77 per cent of total income may be spent on an adequate week's shopping. A postal survey conducted by Shepherd and colleagues (1996) of 400 Scottish adults determined that families in the lowest income group - with a total family income of £141 - were spending the greatest percentage of this income on food, 43% of the weekly income. These values compare with the 17% per week spent on food by families with a total income of £671 per week.

Fresh fruits and vegetables are often found to be most expensive in the poorest localities (Donkin *et al*, 1999). In a cost analysis Cade *et al* (1999) calculate that a family consuming a minimum of five portions of fruit and vegetables per person per day, or a vegetarian diet, may expect to spend up to 49% of total food purchase on vegetables and fruits. This compares to 29% of total purchase in those families not meeting the current recommendations.

2.2 Overview of nutrient intake in children aged 11-14-years old

Such is the significance of nutrient needs in adolescence that these are exceeded only by nutrient requirements at birth. An inadequate diet during adolescence can disrupt growth and development and compromise immune function. Since the origins of diseases such as cardiovascular disease, diabetes mellitus and cancer are recognised to lie partly in childhood diet, and not solely in adult health behaviour, adequate nutrition in childhood and adolescence is paramount (Lifshitz *et al*, 1993). The anabolic activity during adolescence is intense in order to support appreciable increase in height and weight, an increase in lean body mass and also in the redistribution and increase in fatty tissue and the further development of internal organs and systems (Giovannini *et al*, 2000, Olmedilla & Granado, 2000). Dietary intake must make allowances for growth as well as the prevention of deficiency. The diet of children and adolescents has implications for the future health of the nation, particularly when dietary evidence to date reflects a population whose diet is high in saturated fat and sodium and low in fruits and vegetables and antioxidant vitamins. Increasingly, evidence suggests that dietary intake during childhood and adolescence can influence the risk of chronic disease in adult life. Consuming a balanced variety of foods throughout childhood and adolescence promotes optimal growth and development and, in conjunction with other lifestyle behaviours such as taking regular physical exercise, moderate drinking of alcohol and not smoking, can assist in the prevention of diseases such as obesity, cardiovascular disease, iron-deficiency anaemia and dental caries. Whilst health professionals focus upon communicating positive messages about healthy eating the public appear to be agreeable to absorbing the messages but reluctant to act upon them. The perceived control that children may exert over their own diets is a contentious issue in the literature (Robinson, 2000) but it is commonly accepted that independence of food choice increases in adolescence and adolescents do not seem overly concerned with healthy eating messages either.

The findings of the National Diet and Nutrition Survey (NDNS) of young people aged 4-18 years (Gregory *et al*, 2000) supports the apparent trend towards falling mean energy intakes in children aged 11-14 years (Whitehead *et al*, 1982, Hackett *et al*, 1986, Adamson *et al*, 1992a). Mean daily energy intakes were reported to be 8.28MJ/day in boys and 7.03MJ/day in girls (Gregory *et al*, 2000). In a longitudinal study of the prevalence of risk factors for ischaemic heart disease in Northern Ireland, Robson *et al* (2000) reported on the median energy intake of children aged 12-years-old at baseline and at 15-years-old at follow up. Median energy intake by boys aged 12-years was 10.9 MJ/day and by girls 9.0 MJ/day. Adamson *et al*, 1992a reported mean energy intakes in boys of 8.61MJ/day and in girls, 8.25MJ/day. The consistent decrease in mean energy intakes in children of this age has guided the assumption in the literature that energy intakes are declining (Bull, 1988), or that children are becoming less active (Livingstone *et al*, 1992). Alternatively, the incidence of under-reporting may be increasing. It would seem more likely that mean energy intake may be decreasing concomitantly with decreasing levels of physical activity. Additionally, decreasing nutrient intake could not be judged as supporting the steady increase in the height and weight of the adolescent population of many developed western countries. It has also been suggested that should this apparent trend be sustained then adolescents will continue to develop and grow taller and heavier despite a 10% decrease in mean energy intake, which, with the present state of knowledge of the scientific community is unfeasible. One other possible explanation for this trend may be the employment of dietary assessment methods unsuitable to this portion of the population.

Currently, the Dietary Reference Values (DRV's) for fat intake recommend that no more than 35% of daily food energy should be derived from fat. Additionally, saturated fats should not contribute more than 10% of total daily energy. The NDNS report fat to be contributing 35.2% of total energy in boys and 36.1% in girls but that saturated fats contributed 13.8% of energy in boys and 14.0 per cent in girls.

Non-milk extrinsic (NME) sugars should not provide more than 10% of total dietary energy (DoH, 1991). Several studies report excess in the contribution to energy derived from NME sugar in the diets of adolescents. Rugg-Gunn *et al* (1993[a]) report NME sugar to contribute 17% of total daily energy intake in children aged 11-12 years. Doyle *et al*, 1994 also report a 17% contribution to total energy in the diets of children aged 13-14 years. Similar figures are presented in the NDNS; NME sugars contributed 16.9 per cent of total food energy in boys aged 11-14 years and 16.2 per cent in girls of the same age.

The NDNS reports that the Reference Nutrient Intakes (RNI's) for protein (42.1g/day) were being met and exceeded by both boys and girls aged 11-14 years, with corresponding intakes of 64.0g/day and 52.9g/day. Boys are reported to have a higher average daily intake of vitamin A than girls of the same age. Both sexes appear to be meeting the RNI for thiamin, riboflavin, niacin, B6, B12, folate and vitamin C. Of children aged 11-14 years, boys were meeting 96% of the RNI for iron but girls meeting only 61%. Both sexes are reported to be meeting 80 per cent of the RNI for calcium.

2.3 Intake of nutrients by socially deprived adolescents

There are limited studies that report on nutrient intake by socially deprived adolescents. This in itself is an area of nutrition research that requires further investigation. The lack of published data on nutrient intake by socially deprived adolescents must be addressed in order that nutritional priorities in education and dietary intervention be decided and acted upon. Children from lower social class groups have been reported to consume the poorest quality diet (Adamson *et al*, 1992[a], Moynihan *et al*, 1993, Sweeting *et al*, 1994). Adamson *et al* (1992[a]) reported that Northumbrian children aged 11-12-years from lower social group families had lower intakes of calcium, iron, and vitamin C than children from middle and higher social groups and that the nutrient density of the diets (nutrient intakes per unit energy [MJ]) of children from lower social group families was poor. Ruxton and Kirk (1996) reported on the nutrient intake of Edinburgh schoolchildren (n=136) aged 7-8-years-old by social class and their findings indicated that children from families of manual workers had higher intakes of fat and percentage of daily energy derived from fat and significantly lower intakes of vitamin A ($P<0.005$), betacarotene ($P<0.05$), thiamin ($P<0.05$) folate ($P<0.01$) and vitamin D ($P<0.05$).

Bedi *et al* (1990) and Sweeting *et al* (1994) found that children in lower social groups were more likely to add sugar to foods and beverages. Children of parents in social classes IV and V have also been reported to consume more chips, crisps, carbonated drinks, confectionery (Doyle *et al*, 1994) and manufactured meat products (Sweeting *et al*, 1994) and have lower intakes of vitamin A, beta-carotene, folate, thiamine and riboflavin (Doyle *et al*, 1994). In isolation these factors may not be wholly significant, but collectively portray a poor health prognosis for adulthood and old age. This is significant for all adolescents but when additional compounding factors, as recognised to exist in socially deprived areas (i.e. poor availability of fresh fruits and vegetables, restricted range of food products offered by local amenities, sub-standard housing, lack of amenities, high unemployment and occurrence of long-term disability, difficulty and poor attainment in school and so on) begin to affect these adolescents then the effects may be augmented.

The diets of children living in less affluent inner city areas were observed to be high in fat and sugars and limited in fruit, pulses, and wholemeal bread (Johnson & Hackett, 1997). Hackett *et al*, 1997 observe that children from socially deprived backgrounds consume significantly more foods high in fat and salt (Hackett *et al*, 1997) and Moynihan *et al* (1993) found that girls from unemployed families had significantly higher intakes of energy and fat.

Nelson *et al* (1994) observed lower iron status in girls from low-income families. Further work by Nelson (2000) provided evidence of a higher incidence of anaemia in adolescent girls from unemployed families, in addition to lower intelligence quotients that may be associated with lower haemoglobin levels (Nelson, 2000). Moynihan *et al* (1993) report significantly lower intakes of both iron and vitamin C in boys from unemployed families. Socially deprived children consume fewer fruits and vegetables (Doyle *et al*, 1994). Gerhardy *et al* (1995) report consumption of vegetables at lunchtime and at evening meals in lower social class households (group IV and V) with children to be 9% less groups I, II and III. The low consumption of fruits and vegetables by children from lower socio-economic groups was documented by Gregory *et al* (2000) in the NDNS, where both boys and girls from these groups were significantly less likely to have consumed fruit juices, fruits and raw and salad vegetables than children from the higher social class groups. During the seven-day recording period of the NDNS, more than half of young people had not eaten any citrus fruits (76% of boys and 72% of girls) or leafy green vegetables (61% of boys and 56% of girls). Inchley *et al* (2001) reported that 58% children in lower social class groups ate chips every day compared to 29% in children in affluent families and that children in lower social groups consumed significantly less cooked vegetables and raw vegetables and salads. Wrieden (1996) found that 10-11-year-old children in Scotland were consuming an average 2.3 portions of fruit and vegetables per day and that girls in lower socio-economic groups had lower intakes of green vegetables than girls from more affluent families and Anderson *et al* (1994) reported that over a third of children interviewed from the west coast of Scotland ate vegetables once a week or never ate any vegetables at all.

Other studies report lower intakes of brown bread (Sweeting *et al*, 1994, Hackett *et al*, 1986), and lower fruit and vegetable intakes (excluding potatoes) in boys and girls in social class groups IV and V (Hackett *et al*, 1986,). Children from families in lower social class groups tend to have the poorest intake of vitamin C (Adamson *et al*, 1992a), higher consumption of table sugar and sugars from soft drinks (Rugg-Gunn *et al*, 1993[a]), and higher percentage energy from total sugars (Ruxton & Kirk, 1996).

2.4 Food choices towards healthy eating in adolescence

There is a limited amount of information that relates specifically to the food choices of adolescents from socially deprived backgrounds and the lower social classes. Few studies have set out with the intention of investigating the eating habits, intention and desire for dietary change (healthy or otherwise) of young people in the UK. Whilst adolescent food choice is of interest *per se* (and the tracking of food choice from childhood through to adulthood) there is little published work on young people from socially deprived backgrounds.

Adolescent food choice is widely considered to be a culmination of a range of physiological, social, emotional and environmental forces (Warwick *et al*, 1999). It is assumed that the food choices of much younger children are largely controlled by adults (Robinson, 2000). The increasing independence sought in adolescence may manifest in greater control over food choice, particularly outside the home, at school and within the social environment. Indeed, eating differently from the family as a whole is suggested to be common adolescent practice, since this itself is a method of demonstrating independence (Keanne & Willets, 1994). Adolescents within the UK are likely to be within an environment in which there are many possible influences over food choice; these may be exerted by family members (particularly parents but possibly siblings and grandparents), school friends, provision of meals and snacks at school, television advertising and other forms of media. It may be relevant to include the influence of role models and well-known celebrities, in particular sports personalities (e.g. footballers) and of course, young people with celebrity status: musicians and pop-stars. The pressures of presenting a popular and conforming body image must be quite severe for young people today. Glamorous models such as Kate Moss and female celebrities such as Geri Halliwell and Britney Spears are recognised to be the idols of many pre-teens and teenagers and there has always been a fascination from the media with (sometimes 'faddy' and even nutritionally questionable) diet and exercise regimes as followed and promoted by well-known individuals. Whilst this has been traditionally viewed as a female obsession, the influence now extends to boys and young men to conform to a slim and attractive body image. This is perhaps reflected in the increasing incidence of eating disorders such as anorexia nervosa and bulimia, in both females and recently males. This occurrence extends to girls as young as 8 years-old who purport to be following a weight-reducing diet (Pine, 2001).

The influence of family food habits (Mitchell, 1999) or indeed the mere presence of family members when consuming meals and snacks (Jas, 1998) remain significant indicators of adolescent food choice. The fundamental concerns of parents are often ensuring children are eating enough and preparing and serving up meals quickly, whilst nutrition and health (in terms of dietary variety and balance) may not always be a priority (Stratton & Bromley, 1999). Television and the advertising of foods and beverages may also have an influence upon food choice (Young & Hetherington, 1996). Hitchings and Moynihan (1998) cite the findings of a survey performed in 1995 by the National Food Alliance (now known as *Sustain*) that reported children watched an average of 19 hours of television a week. Using a sample of 44 children aged 9-11 years-old, Hitchings and Moynihan reported that the television advertisements for food products most commonly remembered and recalled by the children in a two-week period were (in descending order of frequency); breakfast cereals, crisps, cola, oven chips, soft drinks and microwave chips. Some selected products, namely, crisps, chocolate confectionery, breakfast cereals and microwave chips, were requested by the children and recorded by the main home food purchaser within the same time period of their investigation. Hitchings and Moynihan also reported that strong relationships were found to exist between advertisements remembered and food consumed, notably soft drinks ($r = 0.68$) and crisps and savoury snacks ($r = 0.61$). Whilst the authors acknowledge that a direct assumption that the relationships observed between television advertisements and food consumption need not imply causation it is suggested that children are more likely to remember food advertisements for products they already consume.

Adolescents are frequently referred to as "young consumers" (Brown *et al*, 2000). This particular labelling suggests that adolescents are considered to be potential consumers, that is, having control over food purchase, not simply food choice. Whilst Brown *et al* report a clear awareness of healthy eating requirements amongst adolescent subjects, the strongest food preferences of the same subjects were often for "fast-food" style foods. The authors suggest that although young people may be aware of nutritional information and the potential implementation of such information, effecting change on the basis of theoretical knowledge is met with hesitance.

There are few studies conducted in the UK that have solely investigated the changes in attitude and beliefs of adolescents prior to and following health promotion initiatives. There is some contention in the literature as to whether an increase in knowledge is necessary or indeed singularly sufficient to execute a change in behaviour (Wardle & Huon, 2000).

2.5 Role of food preparation and cooking skills in the health of the nation

To be able to make a range of healthy meals, a number of basic food preparation and cooking skills are required. Indeed when household income decreases, a greater reliance upon practical skills is required to balance the reduction in ready-prepared meals and take-away foods consumed (Anderson & Morris, 2000). When income is restricted, the emphasis on general food knowledge and skills increases (National Food Alliance, 1997) since greater care will need to be taken with meal planning and shopping, with a wider range of skills being required to cook cheaper meals from basic ingredients. In a report on nutrition and lone parent families, Dowler and Calvert (1995) report that possession of cooking skills is one of the factors most likely to indicate a better diet in the individuals of lone parent households.

Lang *et al* (1999) provide much evidence that there is a relationship between cooking skills and health. The 1999 analysis conducted by Lang and colleagues served to highlight the importance of school cookery lessons as the first source of learning how to cook.

Furthermore, the significance for lower social class groups is greater. Of social groups IV and V, almost 40% of respondents indicated cookery classes at school as their first source of learning. Approximately 33% of respondents having achieved either GCSE's only, or having no educational qualifications, relied more upon cooking skills learnt at school later in life, than from any other source. Upmeier *et al* (1999) found that in women consuming the healthiest the diets (in accordance with the WHO recommendations of 1990), 50% had been educated at University level, compared to only 28% of those consuming the least healthy diet.

Young men also rely more on school cookery classes; almost half of 16-19 year olds indicate that they first learnt to cook at school, whilst older males indicate learning from mothers, fathers and friends (Caraher *et al*, 1999). This suggests other lifestyle influences are at work, such as an increase in the number of mothers in full-time employment, perhaps having less time to pass on their cooking skills to their children (Dixey, 1999). Caharer *et al* (1999) comment that the acquisition of cooking skills can contribute not only to the health of young people but to social and emotional development too, but do not qualify this rather profound statement. The National Food Alliance in 1993 commissioned a survey of domestic and cooking activities performed by children. Whilst reporting that 93% of their sample knew how to play a computer game and 61% could programme a video recorder, the National Food Alliance found that only 38% of children had the confidence and ability to cook a jacket potato in an oven (National Food Alliance, 1993). A larger percentage of the children reported being able to peel vegetables and fruit (85%), 79% could operate a microwave oven and 59% knew how to use a grill. This presents a rather confusing picture. It may simply be that the Alliance chose foods or meals that were unfamiliar or daunting to their young sample. However, if 89% of children reported being able to peel vegetables and fruit, this does not suggest apathy or reluctance to get involved in food preparation and to get into the kitchen! Perhaps the more significant findings of this survey are that 66% of the sample indicated that they had acquired their cooking skills from school. This percentage compares most favourably to several other sources of learning; for example, 13% indicated that they learnt from cookery books, 6% from the television or radio, 5% from friends, 3% from newspapers and magazines and 1% on an educational course. In addition, 75% of the children indicated that they wanted to learn more about cooking. An even larger percentage (87%) agreed that it was important for young people to learn to cook and a promising 81% said that it was 'fun to cook'. Cooking is a practical pursuit and can be viewed as a pleasurable and productive activity – the majority of children aged 11-13-years-old in state schools (Key Stage 3) really enjoy practical food lessons at school (Mrs P Graydon, Head of Food Technology, personal communication September 2001).

Watt & Sheilham (1996) assessed the range of food skills possessed by 13-14 year old children in inner city London. Only 5% of children were found to help with cooking at home every day whilst 70% reported helping with cooking once a week or less. The four main cooking methods used most often by the children were heating up foods, baking, grilling and frying. This may say some unfortunate about the current lifestyles of busy families within the UK and of schoolwork and extra-curricular commitments, than about young people's reluctance to cook. This is borne out when examining the attitude statements of the children in this study: 46% of children agreed with the statement 'Learning to cook interests me a lot'. It is likely that most children have other chores to perform in the home in addition to helping out in the kitchen. Again, necessitated by economy of time and effort, children may even be barred from the kitchen when busy working parents do not wish to spend a great deal of time preparing foods when there are many tasks to be accommodated during limited family time.

2.6 Nutrition and cooking skills intervention

It would seem that should the teaching of food preparation and cooking skills in schools still be as widespread and effective as it appears to have been as little as a decade ago (Lang *et al*, 1999) in the development and practice of basic food knowledge, there would not be a pressing need nor case for intervention aimed at increasing the cooking skills of young people in the 21st century.

There is a notable absence of peer-reviewed published literature on dietary intervention and specifically cooking skills intervention studies conducted in the UK in schoolchildren and adolescents. This would suggest most likely that this field of research is yet to be recognised as important to the health of the population and that no studies, with the possible exception of one, to date have been carried out that seek to evaluate a practical skills intervention programme. It is also possible that the importance of evaluating such practical interventions has yet to be embraced by the scientific community and by health professionals.

A large and varied amount of information is available in the grey literature in the form of reports, newsletters and press releases and may also be found published on various web pages on the Internet. Information on studies that are presented in this form are largely qualitative and appear at the present time to be subjective. Sustain (2001^{b}) reported in their newsletter on a community initiative called 'The Good Grub Club', which was established in South Tees in 1995 by community dietitians. The Good Grub Clubs aimed to promote good nutrition and a healthy lifestyle by providing a setting in which to learn new and developing existing cooking skills. The recipes that were featured during the cooking sessions were based upon healthy and cheap ingredients. The purpose of the article was to communicate the idea of the clubs to the reader but did not report on a systematic evaluation of the effectiveness of the Good Grub Club in teaching cooking skills and did not reveal if such an evaluation had been performed. This example serves to the highlight the observation that cooking skill interventions do take place in the community but it is difficult to provide evidence that they are effective. That is not to undermine, however, the value of such community projects. Furthermore, the few intervention studies that have focused on the teaching of practical food preparation and cooking skills in the community setting rarely include a quantitative assessment of diet, nutrition knowledge and cooking skills pre and post intervention period. It is likely that an evaluation of influence upon dietary intake and nutritional knowledge may not have been identified as an achievable or desirable outcome in such projects. The financial costs of carrying out such an evaluation, and cost in terms of manpower, may be prohibitive in such circumstances and it is suggested that this may impact upon the potential for securing funding for community projects.

The Good Grub Club model was focused upon a community development approach to nutritional health promotion. The model was developed for use in the community with adults from low-income families and included the demonstration, teaching and sharing of practical food preparation skills as part of the wider approach to health promotion in the community (Sustain, 2001). This model has been applied for use in adults only but it may be viewed as a useful tool in the development of similar practical food programmes targeted towards children and teenagers. However, its uses may be restricted to the community and it is not clear if such a programme is accessible and indeed applicable to children and teenagers.

The lack of evaluation in terms of effect upon dietary intake and specifically increase in the intake of fruits, vegetables, starchy foods, fibre and a reduction in total fat and saturated fat would appear to a recurrent weakness in the design of dietary intervention studies. Publication and dissemination of evaluation data and recommendations for further would assist health professional in identifying suitable strategies and workable means of getting young people interested in food and cooking.

In a review of the effectiveness of dietary intervention and health promotion studies, Roe *et al* (1998) identify a shortfall of interventions targeted towards adolescents and schoolchildren. Roe and colleagues concluded there was an immediate and pressing need for dietary intervention targeted at adolescents, young people and at lower income families. Additionally, there is an immediate need for dietary interventions aimed at increasing intakes of fruits, vegetables and starchy foods. In 1998 Cox *et al*, reported on a randomised controlled intervention trial that aimed to increases fruit and vegetable intake (to the recommended level of five 80g portions a day) in adult men and women. The intervention included advice on the health benefits of increased fruit and vegetable consumption, explanation on portion size and ways of incorporating more vegetables and fruit in to the diet. Following intervention, 65% of subjects achieved the target intake of fruit and vegetables, with mean self-reported intakes at follow-up (performed at six and twelve months) to range between 4.5 to 4.6 defined portions per day. Cox *et al* conclude that the intervention was successful in increasing fruit and vegetable intake and that the effect could be sustained long-term.

Intervention studies may be more effective when coupled with motivational interviewing, to improve the dietary adherence of adolescents to the advice they have been given (Berg-Smith *et al*, 1999). Motivation is a key issue, since the financial burden, low self-esteem and sub-optimum physical health accompanying periods of unemployment, may reduce the capacity to make dietary change (Anderson & Morris, 2000) and ultimately impact unfavourably upon parental support of interventions designed for adolescents. Peer-education models have been used with some limited success in targeting adolescents included in a health education programme. Hölund (1990) reported on a 'Learning by Teaching' health education programme which enabled learning through assimilating and passing on information about dietary factors in dental diseases. Hölund reported that although the outcome of the study was disappointing because knowledge of diet and dental caries had not significantly increased in teaching group but the study had highlighted that adolescent's short-term beliefs directly or indirectly affect their health-related behaviour and may promote resistance to change and resistance to accommodating dietary advice on the prevention of dental caries.

Hunton (1994) reports on a “Get Cooking” project carried out in a primary school in East Yorkshire teaching food preparation and minimal cooking skills to pupils aged 10-11 years. The six-week programme took place in school during lessons assigned to technology. The cooking project has been detailed in a primarily descriptive and observational manner by Hunton – it does not provide consequential dietary or attitudinal information. Hunton's findings are useful if only in highlighting the absence of health promotion activities that focus upon evaluation of interventions that focus upon teaching cooking skills to children and adolescents from the current literature.

The Royal Society of Art's "Focus on Food" programme was a 5-year, nation-wide food education initiative that took place in schools and included a wider itinerary of supporting community food programmes. Data as yet are to be published from the associated research programme currently being undertaken by the University of Reading (RSA, 1999). This initiative was launched in 1998 under the name "Cooking for kids" and was well publicised in the national press, mainly through the participation of several 'celebrity chefs' (Sherman, 1999).

On the topic of the design, methodology and recruitment issues specific to school-based intervention programmes, there are few published papers on research undertaken in the UK. Many authors reporting on health and dietary intervention programmes do not report on the recruitment issues presenting during their research, preferring to focus on study methodology and data collection and analysis (Doyle *et al*, 1994, Anderson *et al*, 1994). It would be beneficial to all those involved in health promotion and health intervention in UK schools to share and develop suitable methods for the recruitment, selection and retention of school teaching staff, pupils and parents of pupils alike. The dearth of literature on recruitment issues are highlighted by Harrington and colleagues (1997), who reported on the need for the dissemination of research outcomes in relation to recruitment issues. After all, if there are no subjects, there cannot be a research study. Harrington *et al* report on a multi-level approach to recruitment developed and employed in the 5-A-DAY for Better Health national initiative (sponsored by the National Cancer Institute [US]) and attribute 100% recruitment of schools at the district (Local Education Authority) level and senior teaching management level to a high profile recruitment strategy. The authors also suggest that securing the help of community based nutritionists, dietitians and local council school liaison personnel as vital to the success of the overall recruitment programme undertaken for the 5-A-DAY intervention project. Other powerful tools reported in the literature as an aide to successful recruitment and retention of schools and teaching staff are meetings between researchers and school governing boards and bodies, establishing good contact between community nutritionists and school nurses (Petosa & Goodman, 1991), giving a recruitment presentation to all teaching staff who have expressed (or will be expected to participate), identifying a lead contact (teacher) and allowing for later consenting volunteers (Lytle *et al*, 1994a and 1994b), the offering of incentives to class teachers responsible for the collection of consent forms and a persistent subject recruitment programme that follows up particular schools/Year groups and classes not completing consent forms (Harrington *et al*, 1997). Harrington and colleagues reported on the practice of obtaining telephone numbers for parents appearing unwilling to consent to their child taking part in a research study and talking to parents at home and conducting a total of three rounds of recruitment presentations and talks to pupils to encourage participation. Above subject level many of these strategies would appear sound, although it is difficult to say how useful or transferable to UK schools such strategies are. At subject level, however, some of the recruitment practices may appear to be persistent at best but at worst applying too much pressure upon pupils to consent and the contacting of parents may well appear to be an intrusion with the additional effect of turning pupils away from research studies. It would appear that a review paper on the current recruitment methods (successes and failures) employed by researchers in the United Kingdom in both the primary and secondary school setting is long overdue and would be of great value to any institution undertaking school health promotion or intervention.

There is an absence of published literature on dietary intervention and practical food skills intervention undertaken in children and adolescents in the UK where the evaluation has included an assessment of changes in intake of foods and nutrients following intervention. Considerable research projects have been undertaken in the United States but culture differences in ethnical populations and national diet present obstacles in evaluating the potential of such programmes for application in the UK. Additionally, the focus of many dietary intervention studies is the reduction in intakes of fat and saturated fat and few focus upon making positive changes, preferring to do battle with fat intakes. Notably, those studies including a dietary assessment following intervention have achieved small decreases in the consumption of fat and saturated fat and the percentage of total daily energy derived from fat. Dietary intervention to increase consumption of fruit and vegetables has been undertaken in the UK in adults with some success (Cox *et al*, 1998).

A randomised, controlled research study reported by McKenzie *et al* (1996) aimed to decrease intake of total fat and saturated fat in children aged 4-10-years-old (n=300) in Philadelphia, US. The intervention took the form of counselling with a registered dietitian and family-led nutrition education at home. Following intervention children in both the intervention and control reduced their intake of total fat and saturated fat but the findings were not significant. Baranowski *et al* (2000) executed a large, randomised, controlled- trial intervention in children aged 8-14-years-old (*n*=1253) in Houston, Texas, U S. The intervention was delivered to children at schools randomly assigned to the intervention group, through 12 sessions of one-hour duration and repeated when the subjects were one year older. Children were encouraged to taste different fruits and vegetables and their juices, to prepare snacks using fruits and vegetables and follow a series of activities in the classroom on the theme of increasing fruit and vegetable intake and the nutrient properties of these foods. The outcome evaluation was performed through dietary analysis at baseline and following intervention. Children in the intervention increased their fruit and vegetable intake by a mean of 0.88 serving per day compared to an increase of 0.48 servings in the control group. An increase of 0.36 servings/per day of fruit and vegetables were reported by Gortmaker *et al* (1999) as a result of an interdisciplinary intervention in primary school aged children (*n*=479). Other dietary intervention studies have shown some positive impact upon the nutrient intakes of children a reduction of total fat and the percentage of derived from fat and a small increase in the consumption of fruits and vegetables but the findings have not been found to be statistically significant between children attending the intervention and children in the control group (Lytle *et al*, 1996, Nicklas *et al*, 1998).

Weaver *et al* (1999) describe a dietary intervention aimed at increasing consumption of fruit and vegetables in low-income families in Seattle, US. The intervention was structured around advertising campaigns, promoting the benefits of fruit and vegetables and a series of cooking events held in public and community halls and day centres. The cooking events described by Weaver *et al* were demonstrations by outreach workers on the preparation of fruits and vegetables and a featured recipe. Smaller cooking classes were held but again these were demonstrations only and not events where family members could actually cook a dish for themselves but Weaver and colleagues report that the cooking events were an effective source of information about nutrition and provided an enjoyable method of learning for low-income families. One benefit of the cooking demonstrations was described to be the subject's appreciation of a more personal touch in the intervention.

Liquori *et al* (1998) described the outcome evaluation of a quasi-experimental study of a nutrition education programme that included a practical food skills intervention and nutrition education classes in primary school children (n=590). The children were recruited into the study from two public schools in urban areas of high unemployment in Central Harlem, New York, US. Recruitment was by passive consent of parents - no parent refused to allow their child to take part. By class unit, children were randomised into four groups, control cookshop intervention, cookshop intervention and nutrition lessons and nutrition lessons only. The 'cookshops' were organised and taught by twenty teaching teams consisting of a classroom teacher, two students and one parent to 12 children in a practical cookery session. During the 'cookshop' children were able to cook a variety of vegetables such as sweet potatoes, broccoli, and cauliflower and use many different herbs and spices (garlic, ginger, chilli, and mustard) in the recipes selected by the teaching teams. The children also baked and tasted a variety of bread using different cereal flours and were encouraged to use wholefoods in order that they develop skills in preparing vegetables: chopping, slicing, tearing and stirring and so on. The cookshop practical programme was mirrored by classroom nutrition education on the similar foods and focused upon plant foods, the growing of certain vegetables and beans and conducting experiments. Liquori *et al* reported that self-efficacy in cooking was improved in children attending the cookshops but not in those receiving the classroom intervention only but that the impact of the intervention was stronger in younger pupils.

2.7 Extra-curricular food and nutrition activities in schools

A few recent food and nutrition activities that have been taking place in UK schools include; fruit tuck shops, breakfast clubs, the European Network of Health Promoting Schools, (Bowker *et al*, 1999), "Get Cooking" projects (Hunton, 1994), the introduction of a wider variety of fruits and vegetables within school meals (Denman, 1999), pupil-run tuck shops and fruit-sharing schemes between children (Rochford, 1999). The most recent initiative that is supported by the Department of Health and administered through the National Health Service and the Healthy Schools Programme, is the 'National School Fruit Scheme' (DoH, 2001). The 'National School Fruit Scheme' aims to provide free fruit for schools. The scheme is currently being evaluated and data are expected to be available and published in 2002. In 1996, Dixey discusses the relevance of community nutrition education projects targeting low-income families in involving family-focused nutrition education programmes, health promotion projects and practical cookery workshops and concludes that all of these approaches may be beneficial to increasing the knowledge base and practical skills of both inner-city and rural communities.

Schools have the potential to influence the food choices of children by provision of healthy school meals and snacks that may assist towards dietary change (Bowker *et al*, 1999). The nutritional value of school meals is suggested to have declined in many authorities, specifically with regard to providing an excess of energy from fat and sugar and a sub-optimal contribution of vitamins such as iron, folate and calcium (Mock *et al*, 1997). This trend may reverse with the re-introduction of national nutritional guidelines for school meals in April 2001.

The Qualifications and Curriculum Authority (QCA) has set up a nation-wide 'Food in Schools' ongoing project which aims to help schools develop work programmes to involve pupils with food (QCA, 1997). Sustain (formerly the National Food Alliance) have recently launched a pilot project entitled 'Grab 5!' in primary schools to encourage younger children to eat more fruit and vegetables (Sustain, 2001b). The commencement date was September 2001 and an evaluation of the project of the fruit and vegetable experiences of the pupils taking part will be examined to contribute to the development of a national 'Grab 5!' programme.

2.8 The future of practical food skills in the National Curriculum

The concern amongst health professionals regarding the decline in the teaching of cooking skills has been twenty years accumulating in 1993, the 'Get Cooking' campaign was launched in order to put back the teaching of food preparation skills and cooking skills on the agenda and it received a great deal of support and funding from the Department of Health. This serves to highlight what appears to be a lack of communication between the Department of Health and the Department for Education and Employment. The Department of Health has identified schools as an ideal setting for community cooking projects whilst the Department for Education and Employment is busy changing the National Curriculum and allowing the teaching of cooking skills to be undermined. It is suggested that as long as food remains an optional subject within design technology at secondary level education, the equality of food and nutrition education will very likely remain unbalanced throughout secondary schools in England and Wales. In order to redress this balance, it is important that influential organisations such as the British Nutrition Foundation continue to support the move to make food a compulsory option within technology and to sustain and even increase the food and nutrition components of the science and health education curriculum, but also to acknowledge that cooking skills are part of the solution.

In 1995 Gill Fine of the British Nutrition Foundation commented that the Health of the Nation initiative was an important factor in securing the position of food and nutrition within the National Curriculum (Fine, 1995a). Lang & Baker (1993) predicted that the position of food in the curriculum would be unsure and that changes would likely be irreversible, a view shared by Rutland (1993) in a review commissioned by the National Association of Teachers of Home Economics. Both the predictions and concerns of Lang & Baker and Rutland appear to have been completely justified.

The British Nutrition Foundation are also reported to support the belief that in facilitating a comprehensive food 'tuition' of all pupils, the health benefits as outlined in the Health of the Nation White Paper are more likely to met. Fine (1995b) comments that in addition to the health benefit of food education in schools to general population, there will also be some benefit to the 'wealth' of the nation but does not attempt to define what is meant by wealth. However, the British Nutrition Foundation are recognised to support the food manufacturing industry in the UK and the Foundation's agenda may reasonably be viewed as somewhat biased and prone to political influence (not to mention financial support). The Foundation's provision of educational materials and resources do embrace the curriculum requirement for nutrition but many are devoted to the functionality of food components, the production and manufacture of foods within industry and to the use of functional ingredients and additives to support such a large scale manufacture of foods. Within all of this, there seems to be a somewhat persistent argument that certain processes and treatment of food products and the addition various colours, flavours, flavour enhancers, stabilisers, preservatives and so on are both necessary and important in food products.

Disparagingly, it now appears that within the curriculum domestic and cooking skills are rather quaint, old-fashioned and possibly unnecessary when there is so much processed food available to buy. A solid knowledge base of food and the development of safe, hygienic and skilled food preparation would appear to be a less important life-skill than it used to be. The vilification of cooking skills persists with the new curriculum terminology of 'designing' and 'making skills'. It is time to decide, in terms of education, what could possibly be more important – being able to identify and recognise food products and appreciating the manner in which they have been (mass) produced – no, manufactured - for the consumers benefit, or being able to prepare and cook a meal for oneself.

All this presents an absurdity; if food preparation and cooking skills are so out-of-date, compared with advances in food technology, then why does there appear to be a current fascination with the numerous cookery programmes and magazines by the nation as a whole? Indeed, to address technicalities, the appliance of science to food ingredients was well understood by even Mrs Beeton and countless other cooks and chefs before and after, otherwise it would not be possible to understand the making of ice cream [a foam], mayonnaise [an emulsion of two immiscible liquids], pastry [using shortening agents], a gelatinised dessert [a stabilised colloidal system], smoked and salted fish [preservation of flesh foods with compounds incompatible with the growth of micro-organisms], a Victoria sandwich [an aerated mixture], pickled vegetables [preservation by control of pH and parameters of microbial growth] and so on. Perhaps it is only the scale of technology that has changed. However, all this says something more unfortunate about our current perception of these basic domestic skills. Again, in contrast to the enjoyment and pursuit of cooking and amateur chef competitions, it is becoming nostalgic and conventional to appreciate the skill involved in the preparation of foods and put oneself up for ridicule to voice support.

Ultimately, in 2002 the position of food and nutrition is perceivably no more secure that it was in 1995, i.e., in that it remains an optional material within the technology curriculum and is still simply a material. At the present time there are no data from published scientific studies available that indicate or prove that Food Technology as it is taught is in the curriculum has a measurable impact upon the learning and development of food preparation and practical cookery skills by individuals, therefore it is probably unwise to feel reassured that whilst food education is still present in the curriculum no concern is necessary.

Schools have been identified by the Department of Health (1996) as one of several key settings in developing a national approach to addressing the problem of poor nutrition and low income by making intervention activities readily accessible to families and the wider community. This rests upon the facilities that schools have to offer; a teaching room, cookers, equipment and work surfaces, to projects that focus upon community cookery courses, cafes and food-tasting sessions. Schools have many facilities that must surely assist in over-coming barriers faced by many community nutritionists and dietitians when attempting to set up community practical cookery workshops: food preparation areas suitable for small groups and all the necessary small and larger pieces of domestic equipment. Where cooking facilities do exist; the cost of a community food project may be lowered and accessibility improved.

It is of the utmost importance that research is conducted on the effect of practical food preparation and cooking skill programmes upon groups of the population. It is not yet known how these types of intervention may improve the cooking skills and indeed the food choices and dietary intake of the population. The most practical and workable starting point is likely to be in school, since the real requirements for a practical intervention can be readily met by classrooms intended for the teaching of home economics and food technology. Questions are raised concerning the cost of such programmes and the need for experienced and capable facilitators. Those sections of the population most at risk of limited food preparation knowledge and skills and of poor diet need to be included as a priority in structured studies.

It is imperative also that appropriate evaluation of practical skills intervention be thoroughly and professionally undertaken. Such an evaluation would no doubt provide much useful information, resources and experience to guide future projects and to the efficacy of the teaching of food preparation and cooking skills.

2.9 Hypothesis

It is suggested that teaching teenagers and young people to cook can have a positive effect upon their attitude to food preparation, increase their knowledge of cookery techniques and may positively impact upon their dietary intake. Therefore it is hypothesised that effecting an increase in nutrition knowledge in schoolchildren and equipping the same children with a range of basic food preparation and cooking skills can result in the increased consumption of fruits, vegetables and starchy foods. This would reinforce the importance of retaining and strengthening the teaching of cooking skills at secondary school level (Key Stages 3 and 4) within the National Curriculum as a public health initiative to reduce the inequality of diet presented in children from a range of social backgrounds. This hypothesis was tested by evaluating the efficacy of a school-based nutrition and cooking skills intervention, delivered in the form of an extra-curricular 'Food Club' to children aged between 11 and 13-years-old attending schools in socially deprived areas of the Tyne and Wear region.

2.10 Aims

The aims of the study were to:

- **Evaluate the impact of a school-based food preparation and cooking skills intervention on the intake of foods and nutrients in the diets of children from socially deprived backgrounds**

With the subsidiary aims to:

- **Quantify the intake and frequency of total sugars, non-milk extrinsic sugars, sugary and acidic foods in the diets of the children and identify changes within these foods and nutrients following the intervention**
- **Evaluate the impact of the intervention on the nutritional knowledge, food preparation knowledge, cooking knowledge and confidence of socially deprived children**
- **Validate the method of dietary assessment using Physical Activity Levels and analysis of 24-hour urine sample biochemical markers**

Plate 3.1Newspaper article Newcastle Chronicle 03/03/99

Nutrition survey helps schoolchildren develop a taste for study

Food for thought

YOUNGSTERS from a Newcastle school are testing their culinary knowledge by taking part in a good food study.

Pupils at 10 schools throughout Tyne & Wear were asked to take part in the Newcastle University project examining children's attitudes towards eating.

Results

Among them are the 11 and 12 year-olds from Year 7 at School at who have been asked to keep a diary of what they eat. The results will then be analysed over their summer holiday.

They will also take part in a quiz about what they think about different foods and be asked to keep a record of their parents' weekly shopping habits.

The study is part of an 18-month programme by the Human Nutrition Research Centre at Newcastle University.

By GEMMA BLEARS

The aim is to find out young people's opinions on food and particularly those of young teenagers.

The information they receive will give nutritionists at the university vital information to allow them to give advice to children and families on how best to eat.

The children's height will also be measured and the same study will be done this time next year to monitor the changes.

Paula Moynihan from the Human Nutrition Research Centre said: "This study will be really useful.

"Young people's opinions are important and we want to know what the North East pupils think about different foods and what foods they actually eat.

"The pupils from Firfield were great. They really got stuck in. I've never seen children eat so much fruit."

COOKING UP FUN – Year 7 pupils at test some fruit for the University survey which examines children's eating habits and their attitudes towards food

3.1 Introduction

The study was conducted within schools in the Tyne and Wear region. The work presented in this chapter are concerned with the methodology of the study design, issues of recruitment and retention of schools and subjects and the presentation of data specific to subjects, the schools they attended at the time of the study and the Food Technology instruction they were receiving at the time of the study.

3.2 Method

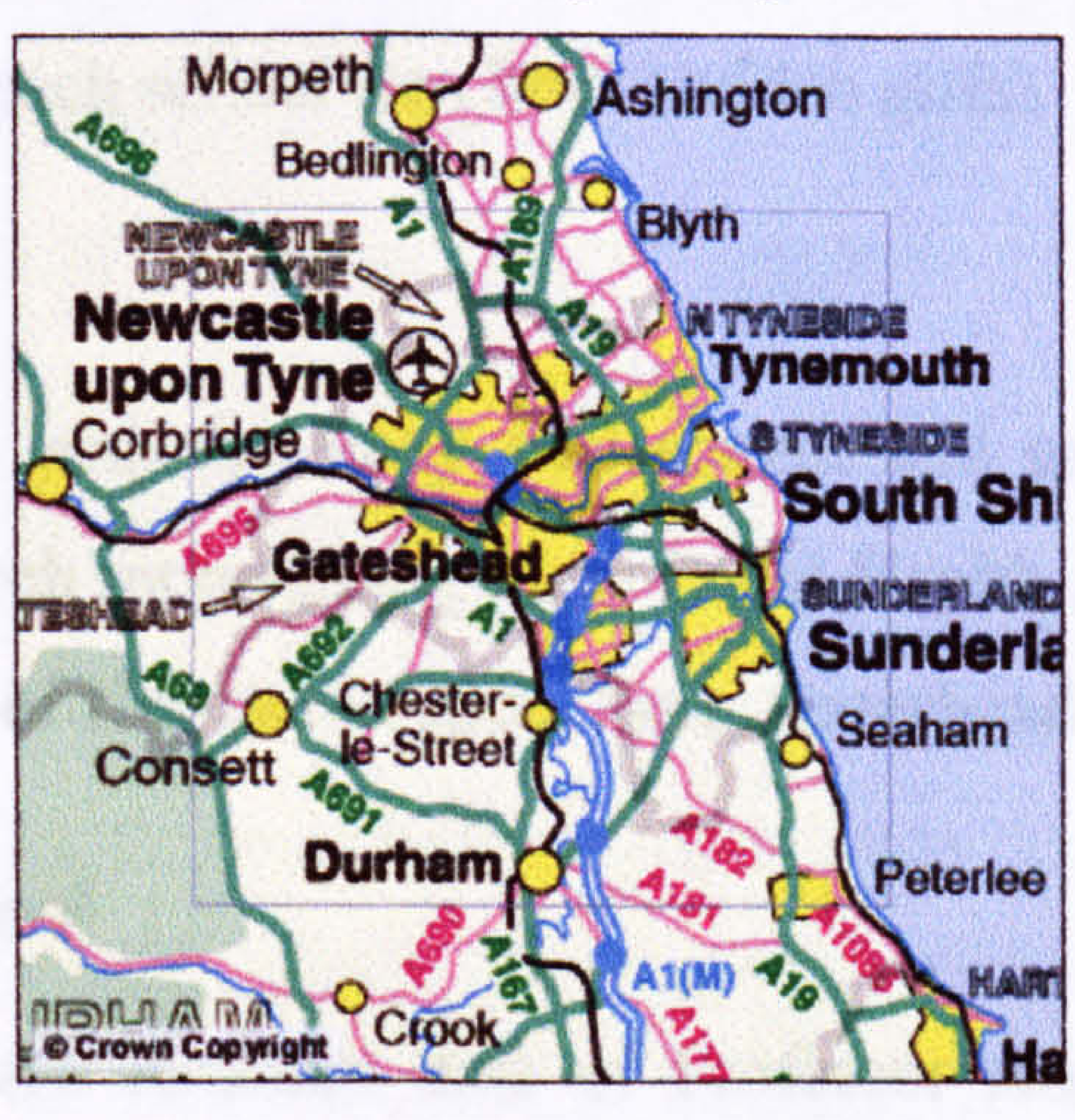
3.2.1 *Study directorship and research team*

The study was managed and directed by the Human Nutrition Research Centre of the University of Newcastle with consultation with the Centre for Public Health Nutrition Research of the University of Dundee. A steering group, under the management of Dr Paula Moynihan, was established to advise on all aspects of the study (Section 12.2).

3.2.2 *Location of schools and subjects*

The study required subjects known to be living within areas recognised as socially deprived. The county of Tyne and Wear was identified as the major region of dense population within the North East of England (Figure 3-1). This region encompasses the cities of Newcastle upon Tyne and Sunderland and the large town of Gateshead, each containing several wards demonstrating severe or significant social deprivation by reference to the criteria of Townsend *et al* (1988). Schools within the Tyne and Wear region having a predominantly inner-city catchment area were required to provide the desired number of socially deprived subjects.

Figure 3-1 The County of Tyne and Wear



3.2.3 Estimation of sample size

It may have been preferable for the determination of sample size to rely upon published data on the standard deviation of change in dietary variables in the diets of children following controlled dietary intervention. In the absence of such data, sample size was estimated by determining the minimum number of subjects required to demonstrate a detectable and significant difference in any one dietary variable following dietary intervention.

Using data from the most recent dietary survey of Northumbrian adolescents (Adamson *et al*, 1992) allowed for sample size to be estimated upon the percent energy provided by total fat in the diet. Adamson *et al* (1992a) report the mean percent energy derived from fat to be 40% (SD 3%). Using the school as the unit of allocation in the first instance, a sample of 14 children per school and a total of ten schools were necessary in order to demonstrate a difference of 2% in the mean reduction of fat intake (power 95). Allowing for withdrawal of subjects increased this figure to 20 children per school, to a total of 100 intervention subjects and 100 control subjects.

3.2.4 Age and sex of subjects

The age of subjects recruited was determined by the age of first learning food preparation skills in school (Key Stage 3 ages 11-14-years-old). In addition to this, several research studies and dietary surveys had previously been successfully conducted by researchers in the Department of Child Dental Health and the Human Nutrition Research Centre of the University of Newcastle (Hackett *et al*, 1983 and Adamson *et al*, 1992) in children aged 11-13-years-old attending middle schools in Northumbria. No differentiation was made or intended between the educational needs of boys and girls and the study aimed to recruit an equal mix of the sexes from each school (ten boys and ten girls).

3.2.5 Ethical approval

Ethical approval to proceed with the study was sought and gained by application to each Ethics Committee for Research representing three Local Health Authorities for the respective Local Education Authorities of Newcastle upon Tyne, Gateshead and Sunderland.

3.2.6 Recruitment protocol

The research protocol and the resultant data of Professor Andrew Rugg-Gunn, Drs Alan Hackett and Ashley Adamson was considered most relevant to schools and schoolchildren within the region and those same protocols were adopted for use in the present study. Ultimately the subjects were required to be aged approximately 11 and 12 years at the start of the study. Children of this age are in the seventh year of education and thus Year 7 groups in secondary schools were to be targeted for the recruitment of subjects.

A multi-level method of recruitment was to be attempted throughout the recruitment phase of the study. Schools were to be recruited into the study by direct contact with Headteachers and Deputy Headteachers by a written letter of invitation from Dr Paula Moynihan of the Human Nutrition Research Centre. Subsequently either the Head of Year 7 or the Head of Food Technology was approached with information about the study with the intent to arrange informal visits to Year 7 pupils.

Subjects were to be recruited by the distribution of a letter written by Dr Paula Moynihan. This letter was sent home from schools to parents and guardians. Signed consent forms were to be collected from teaching staff and a file compiled of all children volunteering to participate. The file included the post-code of subjects in order to determine a Townsend Material Deprivation Score (or Townsend score) for each individual. Twenty children from each school having the highest score (living in the most deprived areas of the region) were to be selected from this list and informed of their selection by post.

3.2.6.1 Recruitment of schools

Schools were recruited using the original protocol described in Section 3.2.4. Further to this it was necessary to follow up written correspondence to schools with telephone calls and visits to teaching staff in schools. A list of senior schools within the region was compiled using up-to-date school directories obtained from the Local Education Authorities of Sunderland, Gateshead and Newcastle upon Tyne. From the directories, secondary schools were selected to the exclusion of a small number of single-sex and private schools and schools where a significant proportion of catchment area was found not to be socially-deprived using the major four components of the Townsend Material Deprivation scores (Townsend *et al*, 1988).

The recruitment of schools was approached by an initial letter sent to the Headteacher of each school. The letter contained details about the study and invited the school to participate (Figure 3.2). This letter was followed up by several telephone calls to promote the study and to establish an appropriate school contact. The recruitment of interested schools was secured by meeting with school contacts, in the presence of Deputy Headteachers and other members of teaching staff.

Teaching staff were informed of what would be required of pupils (and their parents) and a request made to access pupils during schools hours. School staff were briefly informed of the proposed content and delivery of the Food Club in order to understand the facilities (e.g. a Food Technology classroom) which would be required for the Food Club to successfully run as an extra-curricular activity. Information on the total school role, Year 7 role and hours of food technology taught at Key Stage 3 were collected to assist in identifying the criteria to be used in the pairing of schools.

Schools were selected from those who consented to participate in the study. The schools were then paired according to the following; total school roll, number of children within Year 7, total number of teaching hours of Food Technology in Year 7 and the amount of time (hours) devoted to the teaching of food preparation within Food Technology. The pairing of school and subsequent random allocation to control and intervention groups within pairs was undertaken by Dr David Walshaw of the Department of Mathematics and Statistics at the University of Newcastle.

3.2.6.2 Recruitment of subjects

Subjects were recruited using a modification of the original protocol of Hackett *et al* (1983) and Adamson *et al* (1992). The initial level of response from children was much lower than in these previous studies and consequently did not meet the estimated sample size. It became necessary to recruit subjects using a variety of methods: direct contact in schools, letters to their home address, 'advertisement' literature at school and by an awareness-raising process initiated by teaching staff in tutor groups and assemblies. Visits to Year 7 pupils in school to inform on the study were performed by Drs Paula Moynihan and Ashley Adamson and Ms Emma Foster of the Human Nutrition Research Centre to sustain the anonymity of intervention and control groups to research nutritionists responsible for collecting dietary data and to carry out a blind evaluation.

Figure 3-2 Letter to Headteachers inviting participation in the Good Food Study

Human Nutrition Research Centre
Wellcome Laboratories
Royal Victoria Infirmary
Queen Victoria Road
Newcastle upon Tyne

February 1999

Dear

Department of Health funded dietary study of school children

We have recently commenced work on a large-scale, Department of Health funded, dietary intervention study of schoolchildren in the North East. This study will look at the efficacy of after-school 'Food Clubs' as a means to improve the diets of children and their families. For the purpose of this study we would like to target children presently in Year 7 and are looking recruit 200 children from 10 secondary schools from the Tyne and Wear region (i.e. 20 pupils per school). Of the ten schools we hope to recruit, five will be randomly elected as test schools and five will be elected as control schools. We would like to invite your school to participate in this study which will involve the following:

A Nutritionist will visit the school to explain the nature of the study to your pupils in Year 7. All year 7 pupils will be given a letter to take home to parents (enclosed) explaining the nature of the study and asking for parental consent. We would ask that the letter be returned to the school. From the positive responses we will select 20 children who fulfil our study criteria.

Children selected will be asked to keep a 'food diary' for three days on two separate occasions between March 1999 and July 1999 and again on two occasions between March 2000 and July 2000. Our Nutritionist, Mrs. Sam Revill, will be collecting this information which will involve interviewing each child individually prior to and following completion of the diaries. Each interview will take approximately 15 minutes (4 x 15 minutes in total) and we hope to be able to do this causing the least disruption to classes.

The children will also be asked, with the help of their parents or guardian, to complete a 'food shopping diary' for one week by recording all the food purchases that their family makes during seven days. The children will also be asked to complete a short questionnaire about their perceived confidence to prepare foods and their knowledge of food. This part of the study will be carried out by another member of our team, Miss Julie Hooper, who will liase with the parents of the pupils directly and visit the children and parents at their homes to collect this information.

If your school is elected as a test school the pupils will also be asked to attend an after school Food Club which we will organise and provide free of charge. The Food Club would be expected to run after school hours on school premises over 20 weeks (2 hours/week) during two terms (Sept 1999 - April 2000). It will be delivered by a teacher of Food Technology appointed by the Human Nutrition Research Centre and purpose trained by a Nutritionist. All costs involved with the Food Club will be met by the Human Nutrition Research Centre. We are presently collaborating with the National Association for Teachers of Home Economics and Food Technology in the development of the Food Club. It will be designed to include activities based upon the current recommendations for dietary change and will make use of purposely designed educational materials. It will focus upon economical food preparation using limited cooking facilities.

At the end of each term of the Food Club, one of our team would like to interview groups of children, possibly during the lunch hour, and hold individual interviews (of approximately 20 minutes) with selected pupils to seek opinion on different components of the Food Club and its usefulness. These interviews would be held at a time that was mutually convenient.

Irrespective of whether a school is a control school, having the dietary assessments only, or a test school, receiving the Food Club, children who complete the study would be entered into a prize draw at each school to win a £30 gift voucher. Schools who are elected as control schools will be given access to all the Food Club resources at the end of the study. We would also be happy to discuss our findings with the school and the children when the study is completed.

I hope you will agree to your school and pupils taking part in this study. The study outcomes will be used by the Department of Health when deciding future priorities in schools and will also be invaluable use to our research.

If you would like to know any further details about the study please do not hesitate to telephone me - my number is (0191) 222 8241.

Thank you for reading this letter. I look forward to your reply in due course.

Yours sincerely

Dr. Paula Moynihan
Lecturer in Nutrition

The recruitment of subjects was undertaken in three phases that were diverse but not singularly conducted. The first phase of recruitment involved the distribution through schools of a letter further modified from that of Adamson (1992c) to parents with a deadline set for completion and return and of consent forms

Plate 3.2 Taking part in the Good Food Study is fun

The second phase of recruitment employed the use of a professionally produced radio advertisement that was broadcast on a local radio station (Century Radio, Tyne and Wear) for a period of one week. The advertisement gave details of the nature of the study. Two local newspapers, the Chronicle (based in Newcastle) and the Sunderland Echo, were approached with a view to publishing a short article on the study in order to create awareness and appeal to children attending schools in the area. A photographic session was arranged with two schools, one in Newcastle and another in Gateshead, when Year 7 children who had already volunteered to take part where photographed enjoying a selection of fresh fruit supplied by the Human Nutrition Research Centre (Plate 3.2, Plate 3.3). The aim of approaching the local press was to promote awareness, raise the profile of the study in the local community and to secure more volunteers. A pre-written article was supplied to the newspapers in order to prevent essential details and indeed the aim of the study from being published and no reference was made to selection criteria of the subjects.

Plate 3.3 Pupils in Sunderland enjoying fresh fruit

The third phase focussed on promoting the study by informal visits from members of both the research team and with assistance from Ms Emma Foster and Ms Emma Fletcher (HNRC) to Year 7 form classes and year assemblies. The purpose of the visit was to raise the profile of the study and challenge any possible negative perceptions of the pupils towards a University conducted study.

During the visits a second letter of invitation to promote the study to pupils and parents was given to the children. The letter was accompanied by a flyer (Section 12.3) that was designed to be less formal and more appealing to young people. Each letter included a Good Food Study logo that was designed to appeal to children and make correspondence from the Human Nutrition Research Centre easily and instantly recognisable (Figure 3-3). This letter (was also given in some bulk to teaching staff in order that it may be given to any child on request and children absent from school on the day of presentation.

Figure 3-3 The Good Food Study logo

An information sheet (Figure 3-4) and a consent form (Figure 3-5) were designed for both intervention and control schools. The letter to parents and guardians information sheet were designed to adhere to the guidelines laid down by the Ethics Committees of the Local Health Authorities of Newcastle, Gateshead and Sunderland. During this phase colourful posters were also supplied to schools to display to attract the interest of Year 7 pupils.

In intervention schools children were invited to take part in a dietary survey and to attend an after-school Food Club for twenty weeks. In control schools children were invited to take part in a dietary survey only. The letters were delivered to the ten schools in the appropriate number for distribution by teaching staff to Year 7 pupils to take home to parents/guardians.

Additional copies of the letter were given to teaching staff to minimise the reduction in numbers of volunteers due to lost letters and forms, or absence from school on the day the letters were distributed.

Children were also asked to supply details of any other after-school activities they participated in. This information was necessary in the event that there may have been differences between those children already attending extra-curriculum activities and those who did not.

Figure 3-4 Information sheet supplied to prospective volunteers (intervention group)

Human Nutrition Research Centre
Wellcome Laboratories
Queen Victoria Road
Newcastle upon Tyne
Tel: 0191 222 8241

The Good Food Study

INFORMATION SHEET

This information sheet contains details about the Good Food Study and how you and your child will be asked to contribute. Please read it carefully before you consent to your child taking part. If you have any questions about the study, please telephone the number given at the bottom of this sheet.

Taking part in the study is entirely voluntary. All the information that you and your child supply will be strictly **CONFIDENTIAL**. Your child may withdraw from the study at any time without giving a reason.

1. Your child will be visited at school by a Nutritionist, Mrs Sam Revill, who will supply your child with a pocket-sized Food Diary and give full instructions to your child on how this should be completed.
2. Visits to your child in school will be arranged with teaching staff. The visit will take place at a time that is convenient to the school timetable. Your child will be given a slip that will inform them of the day and the time of the visit.
3. Your child will be visited again in school on completion of the food diary. This visit will be to look through the information your child has written down and to collect the diary from him/her.
4. Your child will asked to complete two food diaries in the summer term of school this year, and two next year at about the same time.
5. The Nutritionist will also ask to visit you and your child at home, at a time that is convenient to you. The Nutritionist will ask to measure your child's height and weight and this will be written down.
6. A Nutritionist will also ask your child to fill in a questionnaire. This will be done at school this summer term and again next year about the same time.
7. In addition, Miss Julie Hooper will contact you to arrange a time to visit you at home. You (and your child, if he or she wishes) will be asked to complete a Food Shopping Diary for one week. You will be asked to fill in one Shopping Diary this year, and one next year about the same time.
8. Your child will be invited to attend an after-school 'Food Club' for two hours a week, for 20 weeks (between September 1999 and April 2000) where they will be able to cook and taste a range of foods. The Club will be taught by a qualified teacher of food technology and all ingredients and equipment will be provided free of charge.
9. All the information that you and your child supply will be CONFIDENTIAL.
10. Children who complete the study will be given a certificate of merit and a gift voucher as a thank you for their help.

If you have any questions, please telephone:
Dr Paula Moynihan (0191 222 8241)
Mrs Sam Revill or Miss Julie Hooper (0191 222 8719)

Again, two different consent forms were designed that were appropriate to either the control or intervention schools. The consent forms also adhered to the guidelines set out by the Ethics Committee on appropriate and unambiguous use of language, reference to the confidential nature of information supplied by parents and the protection of this information, the opportunity to withdraw from the study without reason and a signature to confirm reading of all the documents and letters.

Figure 3-5 Parental consent form

Human Nutrition Research Centre
Wellcome Laboratories
Royal Victoria Infirmary
Queen Victoria Road
Newcastle upon Tyne
Tel: 0191 222 8719

The Good Food Study

Consent Form

Please read this consent form carefully and sign if you to agree to your child taking part in the 'Good Food Study' conducted by the Human Nutrition Research Centre of the University of Newcastle

<u>This is to confirm that:</u>
I have read the letter entitled 'The Good Food Study'
I have read and understood the Information Sheet provided
I understand that all information given will be CONFIDENTIAL
I understand that my child may withdraw from the study at any time without reason
I agree to my child taking part in the 'Good Food Study'

Signed...

Your full name (please print)..

Your child's name	
Your child's class	
Home address	
Postcode	
Home telephone number	
Other contact number	

Does your child attend any after-school clubs? (please tick one)
Yes No

If yes, what kind of after-school club does your child attend?

....

Please return this form to....................................by....................................

Thank you

A range of colourful posters and flyers were designed to attract attention and provide a source from which to gain further information (Figure 3-6). Each poster had the name of a designated member of teaching staff who had agreed to supervise the distribution of further letters and consent forms where necessary. The same member of staff also agreed to be responsible for collecting consent forms in school.

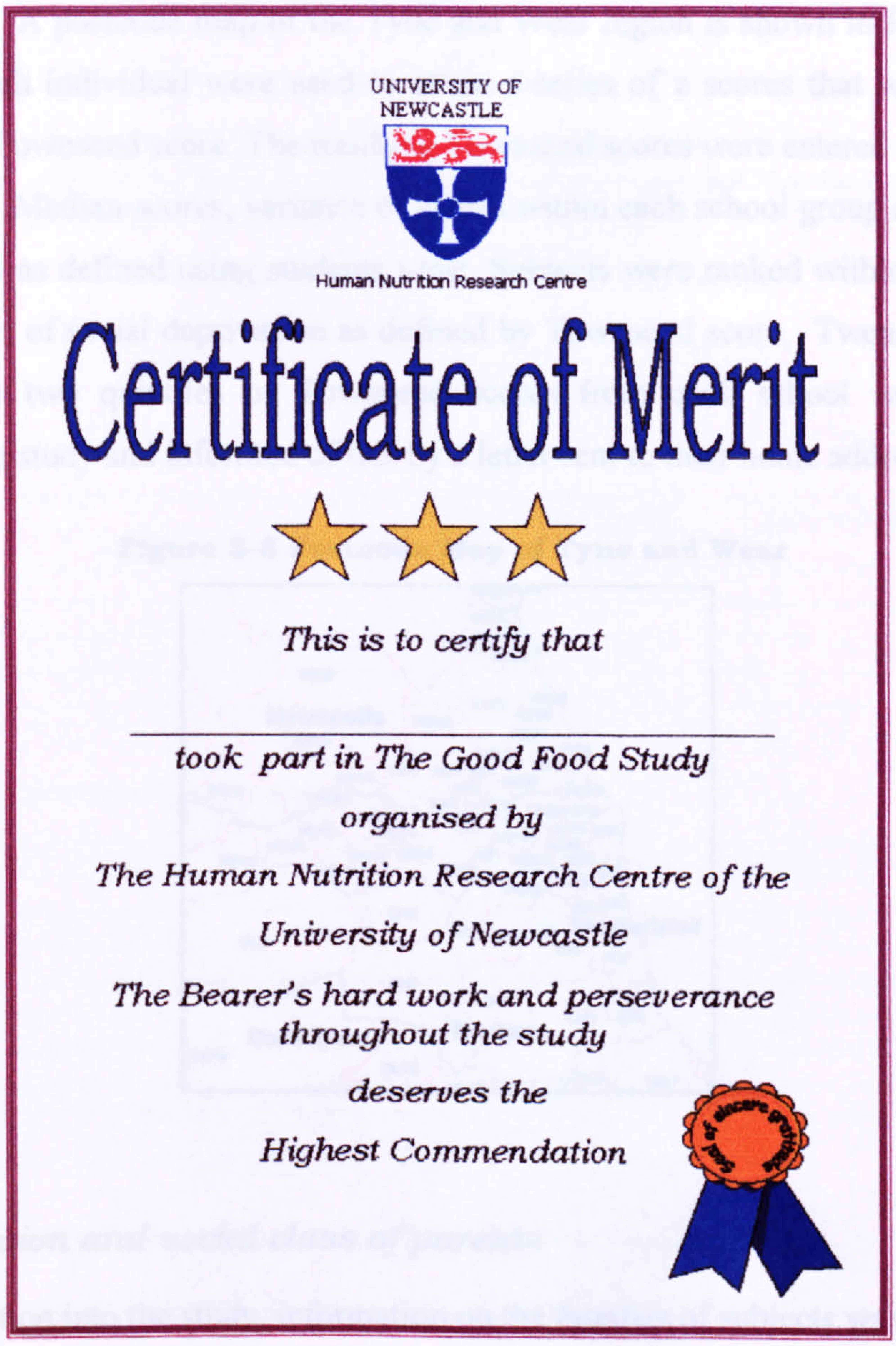
Figure 3-6 Posters displayed in study schools to promote the Good Food Study

Consented replies to the letter of invitation were collected within an agreed time period in school by teaching staff and later collected by the researchers.

Children were also encouraged to take part through a system of awarding a certificate of merit with gold stars that could be included their school Record of Achievement (Figure 3-7). The certificates were shown to children during informal presentations to raise awareness of the study.

The steering group for the project also concluded that it may be appropriate to include a reward to children completing the study as a means of increasing participation. Children were informed during the presentations by research staff that a reward in the form of a gift voucher (for £15.00) would be presented to pupils completing all aspects of the study.

Figure 3-7 Certificate of Merit to be awarded to children completing all aspects of The Good Food Study



3.2.7 Subject selection

Subject selection took place on the basis of assumed material and social deprivation. Following collection of completed and signed consent forms, the address and postcode of each subject were entered onto a Microsoft Excel Spreadsheet. The data were then analysed by Dr Simon Raybould at the Centre for Regional and Urban Development at the University of Newcastle. The data were used to define enumeration district and to allocate the appropriate Townsend Material Deprivation Score (Townsend score) to each individual, using references texts based on the comprehensive work of Townsend and colleagues (1983) further enhanced and modified by the Centre for Regional and Urban Development.

Postcodes that were illegible or omitted from any of the consent forms were obtained through the Royal Mail. A postcode map of the Tyne and Wear region is shown in Figure 3-8. The postcodes of each individual were used to attain a series of z scores that were summed to produce a final Townsend score. The resulting Townsend scores were entered (by school unit) onto SPSS v10. Median scores, variance of scores within each school group and inter-school score variation was defined using students t-test. Subjects were ranked within each school in descending order of social deprivation as defined by Townsend score. Twenty subjects with from the lower two quintiles of Townsend scores from each school were selected to participate in the study and informed of this by a letter sent to their home address.

Figure 3-8 Postcode Map of Tyne and Wear

3.2.8 Occupation and social class of parents

Following selection into the study, information on the families of subjects was collected. Each subject was requested to complete a family details form (Figure 3.9) to obtain information on number, age and sex of adults and siblings (including step-family members) living in their main home. Subjects were encouraged to approach parents and guardians to provide assistance in the completing of these forms. Family details forms were completed at home and returned to a nutritionist during the first individual interview that took place at school.

Figure 3-9 Family details form

The Good Food Study

Family Details Form

As part of the Good Food Study we would like to ask if you would kindly fill in the form below. We would like some information about the people who live in your home, so that when we are looking at your Shopping Diary we know how many people your weekly shopping is intended for.

All information that you provide will be CONFIDENTIAL.

I.D. Number:

Adults living in your home

Name	Sex (male/female)	Date of Birth
1st adult		
2nd adult		

Children aged 16 or under living in your home

Name	Sex (male/female)	Date of Birth

3.2.9 Data processing and protection of confidential data

All data were entered and stored on a computer relational database (Access Database, Microsoft Corporation Inc., C.A. USA) purposely designed and constructed for the study. The designing of the database system was sub-contracted to Dr Paul Adamson (I.C.T. Consultant) and further adaptations to the main database were undertaken by members of the research team as and when required.

As a measure to protect the confidentiality of the subjects and their families, the database system was password protected and only key members of the research team were issued with the password to enter the database. The database was stored on the hard drive of one computer; the access to which was further protected by a password known only to key research team members.

The database automatically assigned a key identity number to each subject that enabled researches to enter any related data using the system of identity numbers only. This removed the need to use family surnames. Additional key identity numbers (which further related to individual identity numbers) were allocated to intervention and control groups and to schools thereby allowing all queried data, reports, summaries and computer print-outs to be viewed at group and school level only.

Data not entered on the database were directly entered onto either a Microsoft Excel (v.6) spreadsheet or onto SPSS (v.10). The confidentiality of the data were further maintained by either using a name and password for individual files or folders according to the format and type of file.

3.2.10 Data analysis

Differences between the intervention and control groups in terms of number of hours allocated to Food Technology and to the teaching of practical food lessons were investigated using t-test. The numbers of children volunteering to take part was calculated and differences between intervention and control group determined using t-test to investigate the potential for the introduction of bias in recruitment of subjects, once group allocation was known to schools, teaching staff and pupils. The numbers of volunteers according to phase of recruitment was calculated in order to highlight the most effective means of recruiting children of this age and children from socially deprived backgrounds.

The occupation of the parents and guardians of the children were entered onto SPSS and differences between the numbers and spread of the parents and guardians occupation analysed using t-test.

3.3 Results

3.3.1 Schools

The response from the 26 secondary schools approached is detailed in Table 3.1. The Headteachers from several schools indicated that the reason they declined to participate arose from the anticipated conflict of time required to spent in school with subjects and with both internal and external school audits and Ofsted inspections. Headteachers (particularly those leading schools designated as 'failing' in their most recent Ofsted report) indicated that parental concerns over removing children from classes for visits with a nutritionist took priority over the potential benefit to be gained by participating. This was demonstrated in six of the schools declining to take part due to curriculum pressures. Three schools were already taking part in other health studies relating to smoking, oral health and physical activity being conducted by the University of Newcastle and the University of Sunderland.

Table 3.1 Recruitment response of 26 secondary schools in Tyne and Wear

Response	Number
Positive	
Positive participation	10
Late positive (reserve school)	2
Declined invitation	
Written refusal (no reason given)	4
Already participating in health studies	3
Study intrusive upon curriculum time	6
Other	
No contact established	1
Total	26

Only in one school could no appropriate contact be established. Administrative staff at this school indicated that the several letters and faxes had probably been circulated to the most appropriate members of staff (i.e. the Heads of health education and food technology) but possibly individual staff members did not want to be responsible for the work that may have been involved in managing a research project in school. Four schools wrote in reply to the initial recruitment letter to decline to participate in the study but did not supply a reason for doing so.

Teaching staff most likely to respond to the letter of invitation were Deputy Headteachers, the Head of Food Technology or the Head of Health Education. The location of the schools recruited, the total roll and Year 7 roll number and number of Year 7 pupils returning parental consent forms are shown in Table 3.2.

Table 3.2 Location, roll number and provision of Food Technology in schools consenting to take part in the 'Good Food Study'

School Identity*	Town/City	Total number of pupils	Number of Year 7 pupils	Provision of Food Technology for pupils	
				Total hours of Food Technology in Year 7	Hours devoted to practical lessons
C1	Newcastle	400	85	13	3
C2	Sunderland	1364	270	18	4
C3	Newcastle	1075	196	12	6
C4	Sunderland	1462	300	16	8
C5	Sunderland	1400	300	16	4
I1	Gateshead	1200	240	13.5	3
I2	Sunderland	1522	270	20	3
I3	Sunderland	1065	240	16	8
I4	Sunderland	823	190	17	8.5
I5	Gateshead	753	210	18	9

* C= Control school, I= Intervention school

Several of the targeted schools were located in areas of Newcastle, Gateshead and Sunderland that were known to the research team as socially deprived and a proportion of these were located on large council estates to admit and serve the local population. All schools were located in inner-city areas of Newcastle, Gateshead and Sunderland. A larger number of schools in Sunderland city (6 schools) agreed to participate than those in Newcastle (2 schools) and Gateshead (2 schools).

The total roll number of the schools agreeing to participate varied between 400 and less than 1522 pupils. This variation in role number is reflected in the Year 7 roll. The roll of Year 7 did not appear to influence the success of recruiting the required number of subjects (Section 2.6.2).

3.3.2 Number of hours devoted to the teaching of food and practical food skills

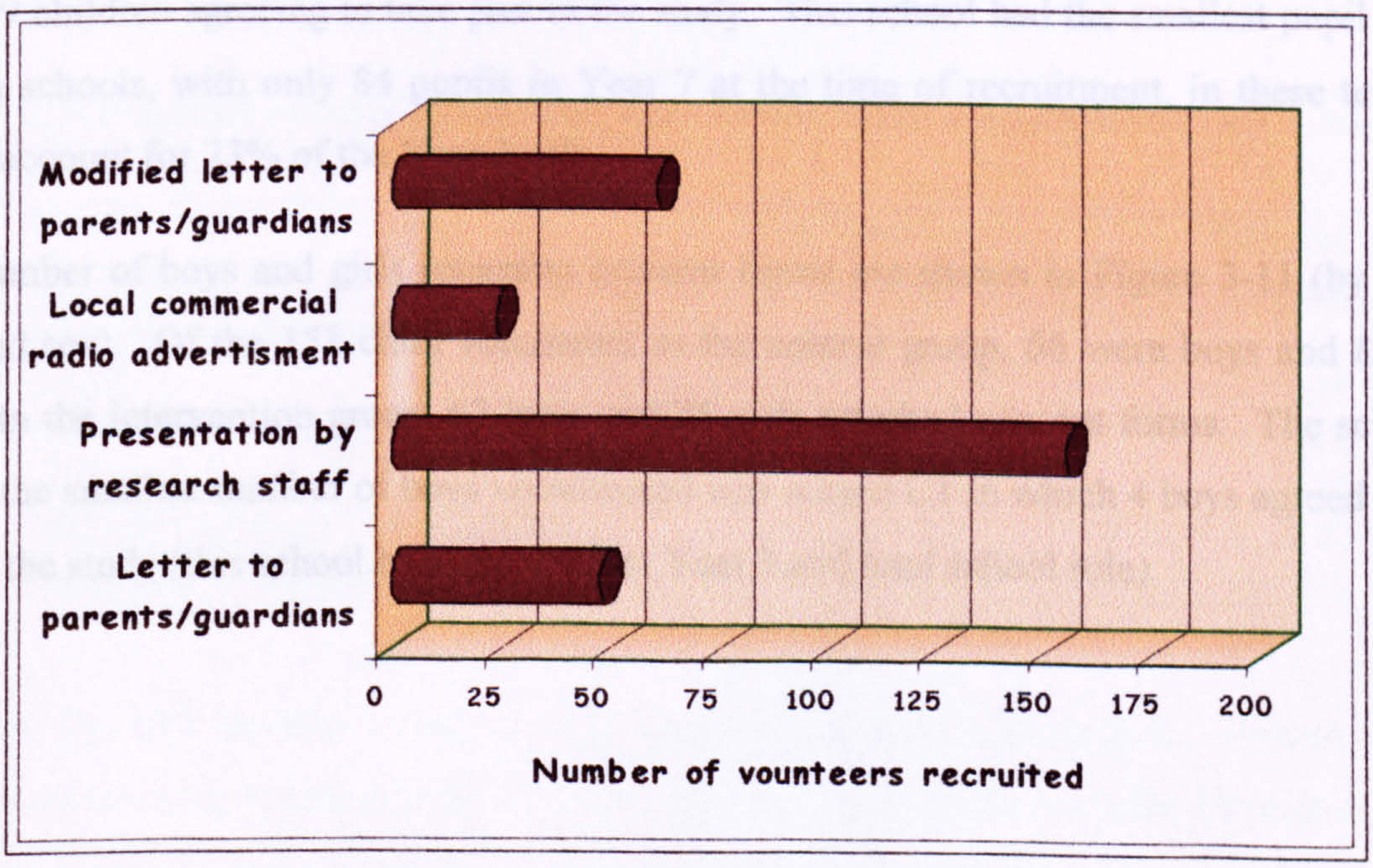
A range in the number of hours allocated to the teaching of food technology to Year 7 pupils was observed in the ten schools. A range between 13 hours and 20 hours of food technology lessons being taught to Year 7 pupils were shown. The mean amount of time allocated to food lessons was 16 hours for an academic year period of approximately 36 weeks. The difference in time allocated to food lessons between intervention and control schools was not found to be significant.

In addition to the range in number of hours allocated to the teaching of food, a range in the amount of time devoted to practical food preparation was also observed. The mean amount of time spent on practical lessons was 5.7 hours for a 36-week period. Practical food lesson time ranged between 9 hours and 3 hours. The difference in hours allocated to practical food lessons between all schools was also found to be significant at P=0.001 (t-test). No significant differences between hours allocated to practical lessons was observed within the intervention and control group schools. Mean (SD) hours devoted to practical food lessons within the control group was 5 hours (2). Mean (SD) hours of practical food lessons within the intervention group was 6.3 hours (3). No significant differences between number of practical food lessons between groups was observed using t-test (P=0.449).

3.3.3 Subjects

In total, 288 children returned parental consent forms. The effectiveness of the recruitment campaign (detailed in Figure 3-10) shows that personal visits by research staff to pupils in school was the most effective part of the recruitment phase, producing notably higher numbers of volunteers than other methods of recruitment. Visits to children in school secured 150 volunteers (approximately 52% of the total number). Letters sent home to parents via children from children were moderately successful and accounted for 100 volunteers. The least successful phase of the recruitment campaign was the use of a radio advertisement, which secured 20 volunteers.

Figure 3-10 Effect of recruitment strategy on numbers of child volunteers



In total, 151 children from the control schools and 137 (62 boys and 75 girls) from the intervention schools agreed to take part in the study. No significant difference (using t-test) between the numbers of children volunteering to take part were found to exist between the intervention and control schools (*P*=0.700). The numbers of volunteers from each of the ten schools are presented in Table 3.3.

Table 3.3 Numbers of children volunteering to take part in the study (by school unit)

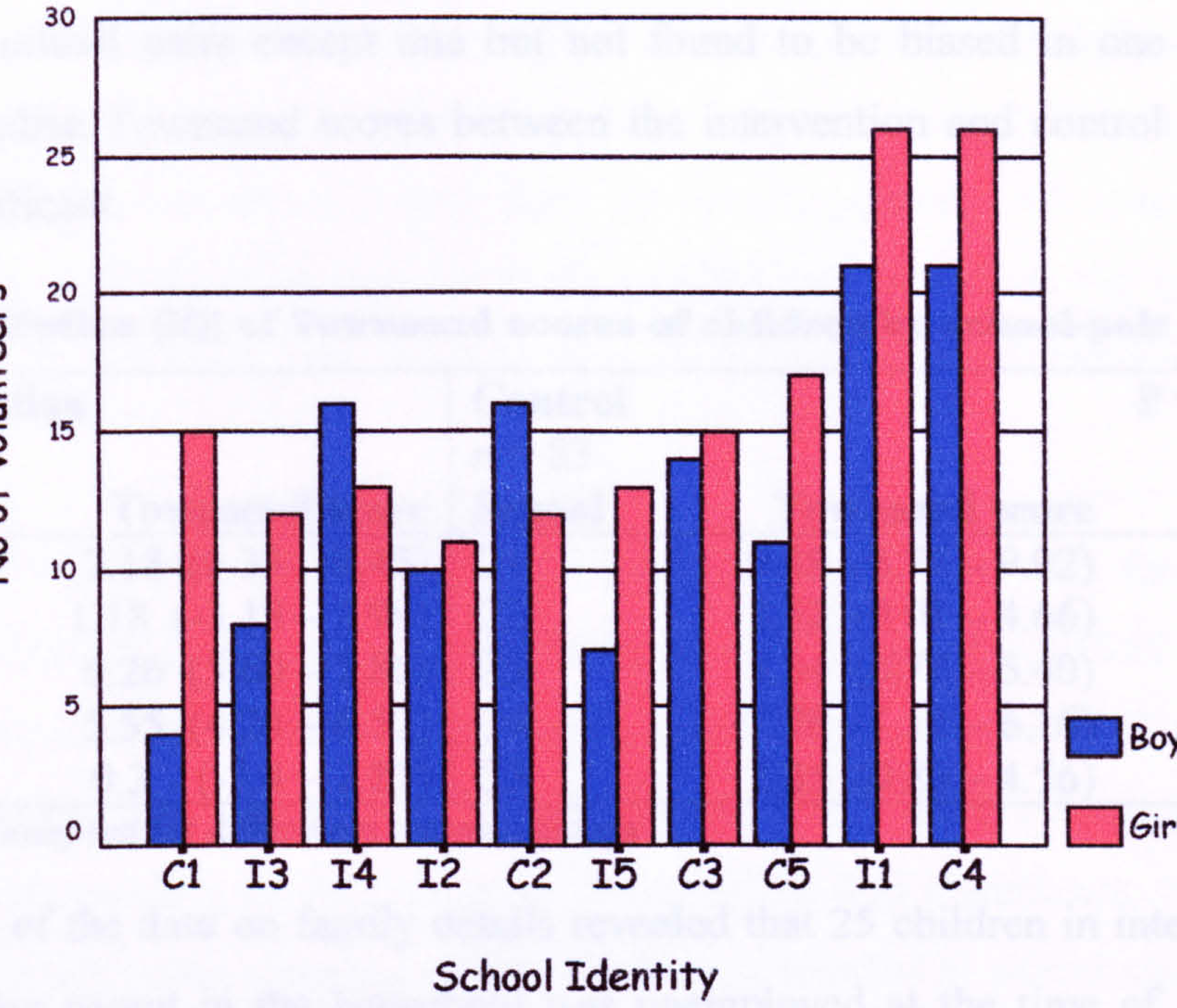
School Identity*	Town/City	Total number of volunteers (n=288)
C1	Newcastle	19
C2	Sunderland	28
C3	Newcastle	29
C4	Sunderland	47
C5	Sunderland	28
	Total volunteers (control)	**151**
I1	Gateshead	47
I2	Sunderland	21
I3	Sunderland	20
I4	Sunderland	29
I5	Gateshead	20
	Total volunteers (intervention)	**137**
	Total volunteers (all)	**288**

* C= Control school, I= Intervention school

In all schools but one the target of at least 20 volunteers was attained. In one school there were 19 children agreeing to take part in the study. This school had the smallest pupil role of the ten schools, with only 84 pupils in Year 7 at the time of recruitment, in these terms 19 pupils account for 23% of the Year 7 role.

The number of boys and girls returning consent forms are shown in Figure 3-11 (by school unit and sex). Of the 151 child volunteers in the control group, 66 were boys and 85 were girls. In the intervention group, 62 boys and 75 girls returned consent forms. The school in which the smallest number of boys volunteered was school C1 in which 4 boys agreed to take part in the study (this school had the smallest Year 7 and total school role).

Figure 3-11 Total number of children (n=288) volunteering to take part in the study (by school unit and by sex)



C = Control Group, I = Intervention Group

Following the allocation of Townsend scores to each child, 20 children with the highest Townsend scores were selected from each school. The initial sample consisted of 98 control group children (38 boys and 60 girls) and 100 intervention group children (41 boys and 59 girls).

Table 3.4 The final sample number by sex, Townsend score and mean age at baseline

	Intervention Group	Control Group
Number completing study		
Boys	31	31
Girls	53	52
All	84	83
Median (IQ range) Townsend score	5.2 (-3.6 - 10)	4.7 (-4.8 - 9.8)
Mean age at baseline	12 years 4 months	12 years 2 months

At phase T1, 167 children completed all aspects of the study (Table 3.4). Sixteen children from the intervention group withdrew from the study, of which 10 were boys and 6 girls. Fourteen children from the control group withdrew of which 7 were boys and 8 girls. One further boy (control group) was excluded from the final sample number due to insufficiently complete 3-day food diaries. The mean age of all subjects at baseline was 12 years 3 months.

Median and interquartile range of Townsend scores of children by school group are shown in Table 3.5. Differences between median Townsend scores were found to be significant ($P<0.05$) in all school pairs except one but not found to be biased in one direction. The difference in median Townsend scores between the intervention and control group was not found to be significant.

Table 3.5 Median (IQ) of Townsend scores of children by school-pair grouping

Intervention $n = 84$ School	Townsend score	Control $n = 83$ School	Townsend score	P value*
I1	7.18 (6.33 – 8.45)	C1	9.48 (6.74 – 9.92)	0.025
I2	1.18 (-3.18 – 2.99)	C2	2.52 (0.01 – 4.66)	0.076
I3	6.26 (5.60 – 7.86)	C3	5.34 (0.78 – 6.40)	0.018
I4	5.55 (4.24 – 6.52)	C4	2.78 (1.12 – 6.16)	0.030
I5	0.3 (-3.4 – 2.81)	C5	2.35 (0.80 – 4.56)	0.019

* Mann-Whitney test for differences between groups

A brief analysis of the data on family details revealed that 25 children in intervention group indicated that one parent in the household was unemployed at the time of completing the questionnaire. Twenty-two children in the control group indicated that one parent in the household was unemployed. There were no indications that both parents in any one household were unemployed. In both the intervention and control group, the numbers of fathers (or adult males) who were unemployed were greater than that of mothers (or adult females). From a total of 167, 47 children had a parent or guardian who was unemployed.

3.4 Discussion

The recruitment of schools took longer than anticipated – approximately eight weeks when only four weeks had been considered necessary. Previous studies conducted by the Human Nutrition Research Centre had not encountered any serious difficulty in recruiting schools to take part in dietary surveys. However, all previous studies had been conducted in Middle Schools in Northumbria and access to pupils was not viewed by teaching staff as problematic. Headteachers and senior teaching staff in secondary schools may have been wary of allowing visits to pupils during school hours and may have been reluctant for pupils to miss core curriculum subjects. This reluctance may have accounted for the longer period required to make personal visits to teaching staff and secure recruitment of the school. In addition, the heavy workload of the teaching staff allowed for little free time to accommodate visits from research staff to offer information and reassurances about participating in a study conducted by the University.

The attitude of schools towards participation in the study was positive overall and the aims of the study considered to be both laudable and stimulating in terms of education research. This was a view communicated by all teaching staff who were spoken to regularly about the study during the recruitment of schools. Senior members of staff looked favourably upon their pupils receiving some educational input from an outside source. All school staff, at the recruitment stage, held the view that the study would be of benefit to the pupils and were prepared to become involved, and in effect take extra work upon themselves, in order for pupils to benefit.

All school staff were particularly interested in the development and running of extra-curricular activities for pupils and the possibility of hosting an after-school food club was appealing to most schools. With funding having already been secured for the setting up and running of the club, the provision of a well-qualified and experienced teacher of food technology and the meeting of the cost of all consumables and ingredients, many aspects of the Club were already being managed which may have attributed to school staff consenting to take part.

The member of staff responsible making such a decision on behalf of the school appeared to vary. This created some difficulties in the recruitment process. For example, in one school, the Deputy Headteacher agreed that the school should take part in the study, and delegated the school management issues to a more junior member of staff who appeared to be less enthusiastic. The reverse case also presented itself; one teacher very much wanted a school to take part but was unsuccessful in securing the backing and agreement of the Headteacher.

Overall, the recruitment strategy was effective in that it produced the required amount of schools to participate in the study and a further two schools that agreed to be held in reserve in the event of another school withdrawing. Future school-based studies should allow a longer period of time for the recruitment, simply because it is difficult to speak personally to teaching staff and arrange visits when the staff have a heavy timetable loading. It may be extremely beneficial to researchers setting out to conduct a school-based study to spend time in schools, possibly carrying out focus-groups with teaching staff, to discuss the views of schools in the area towards research studies and the amount of time allowed to access pupils during the school day. It would also enable researchers to identify potential problems and to discuss appropriate solutions with teachers of all management levels. Key to the success of recruiting appropriate numbers of schools is establishing a suitable contact within in each school and for the purpose of future work, these members of staff are most likely to be Deputy Headteachers (Headteachers are extremely busy with the school agenda), the Head of Technology, the Head of Food Technology and the Head of Health Education.

It may also be worthwhile on the part of researchers to devote some considerable time to promoting the study and spending time in school with teaching staff to address any potential problems. This could be successfully achieved by giving a presentation about the research institution and the research agenda (whilst not giving specific details of the methodology or anticipated outcomes) perhaps accompanied by the provision of refreshments and in the case of practical cooking skills interventions, samples of dishes to be cooked by the children. This is an approach that has been used by the Human Nutrition Research Centre in the recruitment of General Practitioners to primary care research programmes and has been suggested to be useful in giving research studies a professional air and purpose (Helen Moore, 2000, personal communication).

The information collected in the recruitment phase also allowed some light to be shed on the actual amount of time allocated to the teaching of food in secondary schools in the area. It is probable that the variation in time allocated observed in schools in the Tyne and Wear region is a reflection of the UK as a whole, since the region encompasses some four Local Education Authorities.

It became apparent that although there are similarities between the number of hours of food technology allocated to Year 7 pupils, there was a large discrepancy in the time devoted to practical food preparation in the classroom. No data were collected on the number of hours allocated to food preparation in Years 8 and above. Since teachers of food technology and their Heads of Department are able to interpret the curriculum as it is deemed appropriate within their school, this may result in schools following a slightly different scheme of work in the lower school. In turn, this may account for the differences in the hours devoted to practical food skills as observed in the schools participating in this study.

It is wise to consider that a potential for bias may have been introduced through the allocation of schools to control and intervention groups before the recruitment of subjects commenced. It is possible that group allocation, when known to pupils, may have affected numbers of pupils who agreed to participate in the study. The results show that a greater total number of children were recruited in control schools. This may imply that either the recruitment process was more effective in control schools or it may imply that the commitment required in attending the Food Club may have deterred some children from volunteering. Further analysis, however, of the recruitment data using a Mann-Whitney test shows that there were no significant differences revealed between the groups in the numbers of children volunteering to take part in the study (P=0.841).

It is interesting to note that the greatest numbers of recruits were obtained in two schools, one of which was control school (C4, 47 volunteers) and the other an intervention school (I4, 48 volunteers). In view of the identical manner in which the recruitment of pupils was conducted in all schools (all schools received the same letters, flyers, posters and visits by research staff) it would appear that recruitment in these two schools was particularly successful. This may be due to the influence and enthusiasm of teaching staff in these schools which may have resulted in the higher numbers. This may again support the suggestion that the allocation of schools to control and intervention group did not effect numbers of volunteers.

It may be appropriate in some cases for future studies of a similar nature to carry out recruitment of child volunteers immediately after the recruitment of schools in order to minimise the potential for bias. Whilst this may reduce the potential for bias in the recruitment of volunteers it may also introduce difficulties in that it is an ethical requirement for volunteers to be fully informed before agreeing to take part in a research study. In view of this, it would therefore be necessary to notify children that they may have the opportunity to attend an after-school Food Club in order that they may make a fully informed decision to participate. This would be extremely important since taking part in the study and attendance to a Food Club implies a commitment on the part of the children. It would seem to be greatly unfair to inform children that they may have the opportunity to attend a Food Club, which many may find very appealing, but later to withdraw this opportunity on account of their particular school having been randomly allocated to a control group. For children of this age, this approach appears a little mean-spirited and may discourage children from volunteering to take part in further studies. Offering attendance to a Food Club at the end of the period of data collection for the entire study would be of benefit to children in the control group without effecting the post-intervention data. This would also have the effect of increasing the total cost of the project so may not be feasible from this aspect.

Obtaining signed parental consent forms from subjects was largely undertaken by teaching staff in school. Several teachers recommended having a 'post-box' placed in school in order that pupils could return their forms quickly and easily. The majority of consent forms were appropriately completed and missing postcodes were very easily identified using the post-code search facility of Royal Mail. The use of post-codes was a convenient method for measuring deprivation without the need to ask parents about their occupation.

The Registrar General's Classification of Occupations is one of the earliest and most widely used measure of social class (Leete & Fox, 1977) but it has be shown to have some limitations; the long-term unemployed and single parents in receipt of benefits cannot be classified under this system which would have made this particular measure of social class unsuitable for the subjects participating in this study. Post-codes easily facilitated the determination of Townsend scores.

There were no large differences in the number of boys and girls who volunteered in the control and intervention group, with the exception of school C1 where 4 boys and 15 girls returned consent forms. This school had the smallest Year 7 role and total school role. It was also the school with the highest median Townsend score (9.48). The distribution of the sexes within recruits in the majority of the schools is comparable, which may demonstrate that both the sexes are equally agreeable to taking part in a dietary survey.

It is suggested that in future studies the recruitment methods used in this study are appropriate for children aged between 11- and 12-years-old but it may be wise to consider how to make participation in research studies particularly appealing to boys. The additional factor of severe social deprivation may reduce the number of boys who feel they wish to participate. Since the small number of boys recruited from school C1 appears to be an isolated occurrence within the ten schools in this study, the recruitment methods overall are probably suitable. In the case of school C1 there may be additional local factors that had affected the choice of the boys to participate and this may need some further investigation to attempt to identify what these factors are.

"I've learned how to work a cooker, and how to chop things up and make them cook properly and how to sort of weigh things out as well"

Girl, having attended 13 sessions of the Food Club

"Like how to hold a knife, how to do things, tidy the place up and all that. Health and safety in the kitchen. Be hygienic. Just stuff about don't put hot and cold and stuff together, for germs".

Boy, having attended 13 sessions of the Food Club

"...he made some quite good things he did. I mean the likes of the curried vegetables...I used to think 'Oh Tuesday, I'll not make any tea for myself, I'll just eat what [son's] having at the Food Club'...some of the ordinary everyday stuff was really nice. The cooking itself I thought was marvellous. He has got a good hand cooking, he has. Actually I didn't think it would be that good, the cooking itself. I didn't think he could be that good at making things"

Mother of boy who attended 20 sessions of the Food Club

4.1 Introduction

The dietary intervention was delivered in the form of an after-school 'Food Club'. The main content of the Food Club was determined by an emphasis upon the teaching of a range of basic food preparation and cooking techniques, with a range of recipes selected according to the application of teaching each particular skill. It was necessary for the Food Club to be able to operate using minimal equipment and consumables in order that the recipes made at the Club could be repeated in the subject's homes. This section aims to provide further information on the intervention itself in terms of design, educational content and delivery and give details regarding the aims of the intervention and the practical interpretation of these aims.

4.2 Design and content

The content of the Food Club was designed primarily by Mrs Tracey Cowell in consultation with Dr Paula Moynihan. The Food Club was designed to include several activities: eating a healthy snack at the start of the session, cooking two different recipes, trying a new or unusual food, maintaining and updating a Food Club recipe book and joining in with food related quizzes.

Plate 4.1 Preparing baked apples

The nutritional content of the club was developed by Dr Moynihan and the practical teaching aspects and daily running of the club were the responsibility of Mrs Cowell. The Food Club content was divided over a programme of twenty sessions to be taught in schools commencing in the autumn term of 1999 and terminating in the following spring term of

2000. The duration of the Club was intended to be two hours per session, including time for children to have a drink and snack on arrival.

The Food Club commenced in the autumn term when children were in Year 8 at secondary school. The club ran for 20 weeks from September 1999 to April 2000 and was divided into four blocks of 5 weeks duration, in order to coincide with the academic half-terms. All ingredients, aprons, recipe sheets and also recipe books were provided by the Human Nutrition Research Centre. The budget for the study allowed £2 per child per session from which all ingredients were provided.

4.3 Establishing the food club in intervention schools

A meeting between Mrs Cowell and teaching staff at each of the five intervention schools was held in order to clarify the content and delivery of the club. The schools were asked to provide a suitable teaching room for the club. Food Technology classrooms were deemed the most appropriate because of the requirement for a number of ovens and hygienic work surfaces as well as items of small equipment. Health and safety requirements were discussed at length to the satisfaction of the school. A letter was sent home to the parents and guardians of children attending intervention schools to inform them of the day of the week upon which the Food Club would be held in their children's school. This letter also asked parents to inform Mrs Cowell how their child would travel home so that onus of safety of the child on leaving the Food Club was the responsibility of parents.

Plate 4.2 Fruit kebabs

Health and safety aspects of the club were of a priority and schools were encouraged to address any issues of concern regarding safety of the pupils working in technology classrooms after school. Senior members and school caretakers were consulted regarding the availability of technology classrooms after school hours. Food Club teaching assistants were provided in schools requiring more than one member of staff to present during the club in accordance with healthy and safety regulations and to provide teaching cover in the event of injury or similar first aid incident. The teaching assistants were trainee Food Technology teachers sourced from the Education Department of the Universities of Northumbria and Sunderland. In addition to assistant teachers, several Food Technology technicians already resident in the schools were employed by the Human Nutrition Research Centre to participate in the club to provide for those schools stating a preference for a technician to be present to assist in the preparation and maintenance of equipment and cleaning the room.

Following consultation with school staff regarding the appropriate running time of the club, parents, guardians and children were informed of the starting and finishing time of the club for each intervention school. The club aimed to commence approximately 15 after the finish of school, to allow pupils a short rest period and time to arrive at the club and continue for two hours.

4.4 General features of the Food Club Programme

The teaching structure of the Food Club was designed, planned and executed by Mrs Cowell, a qualified and experienced teacher of Food Technology. General health and safety rules and guidelines were administered to children at all times throughout the running of the club. The recurrent features of the Food Club included attention to good practice in technology classroom and when working at home and included the following items where required in each session:

- working safely and hygienically in the classroom and the kitchen
- identifying and dealing with safety hazards (electric appliances, spilt liquids)
- preventing/dealing with small injuries (cuts and burns)

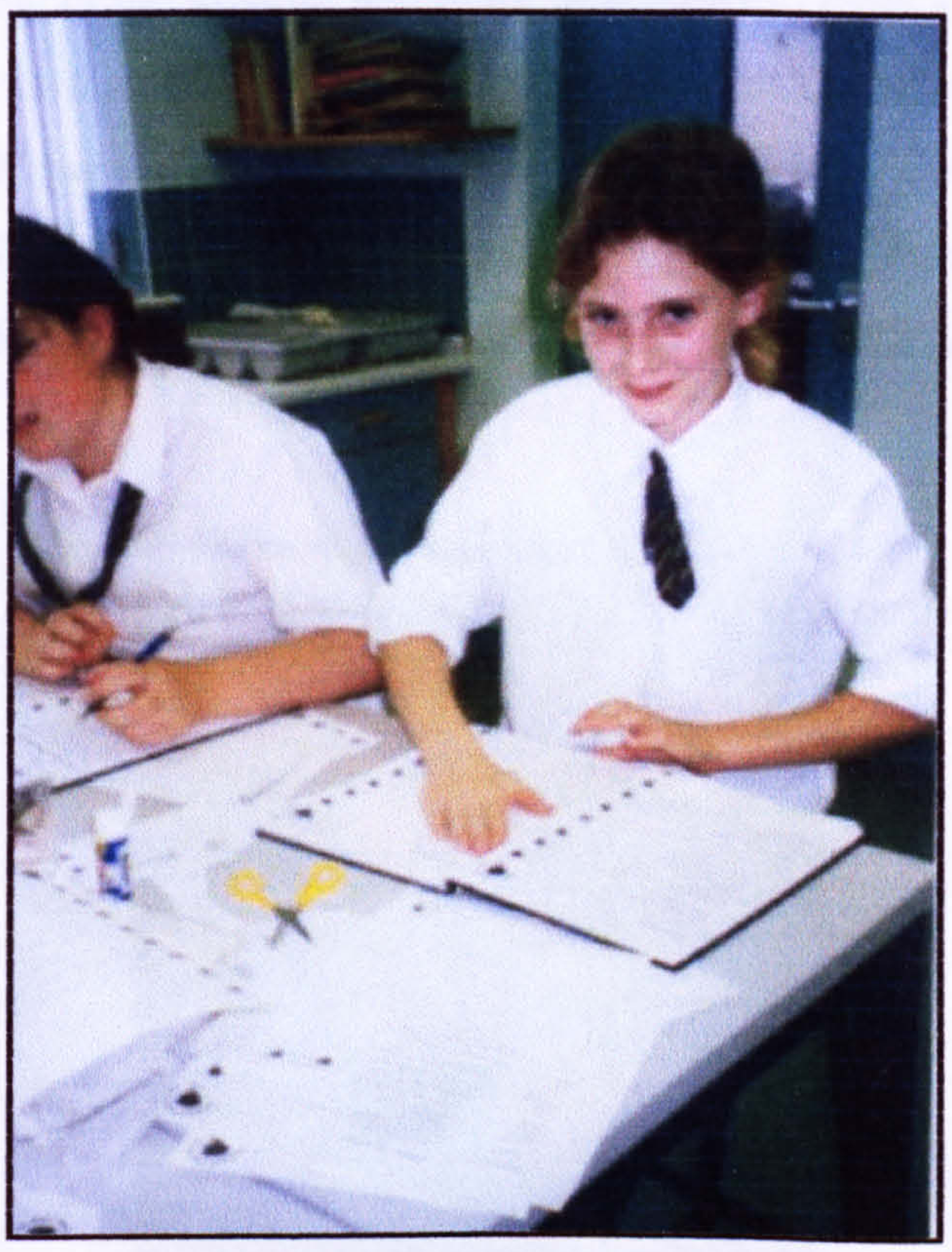
- awareness of food safety and hygiene and attention to hygienic working practices
- correct storage of ingredients and perishable foods
- awareness of working safely with gas and electric ovens
- safety features of a microwave oven
- using radiant rings/hobs/gas burners
- using a grill
- understanding the regulation of cooking temperatures and the role of the thermostat
- consideration of shelf-life
- selecting the most appropriate piece of small equipment for a task
- safe handling of sharp knives
- correct use of chopping boards for meats, vegetables, dairy products and breads
- cleaning and safe storage of knives and other small equipment
- using oven gloves to prevent burns and scalds

In addition to basic skills, the focus of the Food Club was increase the children's experience of handling, preparing and tasting a wide range of starchy foods, fruits and vegetables. At the beginning of each session the children were given a snack, and a drink of milk, juice or water. The recipes chosen for children to prepare at the club were also carefully selected to introduce the handling, preparation (Plate 4.1, Plate 4.2,) and cooking of cheap but healthy foods.

Each Food Club was brought to a close by providing time for each child to stick the recipes used in the session into a purposely designed Food Club Recipe Book (Plate 4.3) and by providing a new or unusual food, often a fruit, for children to taste. The club provided a recipe sheet for all recipes cooked by children at the club and also a loose-leaf version that could be taken home.

Children were frequently photographed at the session and these photographs could be mounted in the Food Club Recipe book to serve as an illustration of the children's work. Differentiation at the club was provided for by a stock of food-related quizzes and activities for those children who completed all practical work.

Plate 4.3 Food Club recipe books



4.5 Fruits, vegetables and starchy foods included in the Food Club programme content

Along with the teaching of basic skills, the Food Club aimed to increase children's experience of fruits and vegetables and starchy foods. In addition to the preparation and cooking of these foods, education on the nutritional value of these foods was included in the teaching points of each session by Mrs Cowell.

Fruits and vegetables were promoted positively to the children as being tasty, a good choice for a quick snack and a good source of fibre as well as providing a variety of vitamins and minerals. Starchy foods were promoted as being preferable sources of energy in the children's diet and discussed in terms of being filling, cheap and replacing foods with a higher fat content in the diet. A range of recipes that contained either a starchy food, fruit or vegetable, or a combination of these as main ingredients were specifically chosen in accordance with the aims of the club. The programme of club contained a range of starchy foods such as pasta, rice, potatoes and breads, plain and savoury scones, either in the snack foods provided or as the basis of a recipe. Similarly, fruits and vegetables were included in the same manner; exotic and tropical fruits were provided during the tasting sessions, fruits were supplied as a snack and featured in recipes such as desserts and smoothies. Vegetables formed the basis of many of the savoury and main dish recipes (Plate 4.4,Plate 4.5). Root and salad vegetables eaten in dishes common to most children of a similar age were featured in many of the recipes. However, attention was given to vegetables and also spices and herbs that were considered likely to be less familiar to the children, for example fresh chillies, root ginger and parsley. These constituted ingredients in many of the savoury and main dish recipes.

Plate 4.4 Vegetable stir-fry

4.6 Healthy snacks provided at the Food Club

On arrival at the club, all the children had an opportunity to have a snack if they wished. The snacks provided were carefully chosen and were selected through including either a fruit, vegetable or starchy food as a base for the snack (Plate 4.8). A drink of water was also provided for the children in brightly coloured plastic jugs and cups. The range of snacks provided are shown in Table 4.1.

Table 4.1 Healthy snacks provided for children at the Food Club (weeks 1 – 20)

Week Number	Snack
1	Banana Tea Bread
2	Yoghurt
3	Pinwheel sandwiches
4	Fruit scone
5	Digestive sandwich
6	Edam cheese, apple slices
7	Popcorn
8	Vegetable sticks with breadsticks
9	Sandwiches
10	Christmas snacks, Christmas cocktail
11	Vegetable soup, bread roll
12	Carrot cake
13	Savoury boat sandwiches
14	Slice of fresh fruit
15	Porridge and fresh fruit
16	French bread, reduced fat cheese, grapes, celery
17	Fresh fruit salad
18	Fruit smoothie
19	Fruit cocktail
20	Minestrone soup

Plate 4.5 Making a coleslaw filling for a jacket potato at the Food Club

4.7 Programme of practical work and cooking skills

The Food Club was designed to teach a range of basic cooking skills to children by a demonstration. The programme of practical work included a range of food preparation techniques shown to pupils in a step-by-step process. During each session of the Food Club, the children cooked two recipes. In addition to the teaching of basic cooking skills, relevant and thorough reference to safety and hygiene in the food room (and the kitchen at home) was included during each session according to the teaching points set down by Mrs Cowell (Section 4.4).

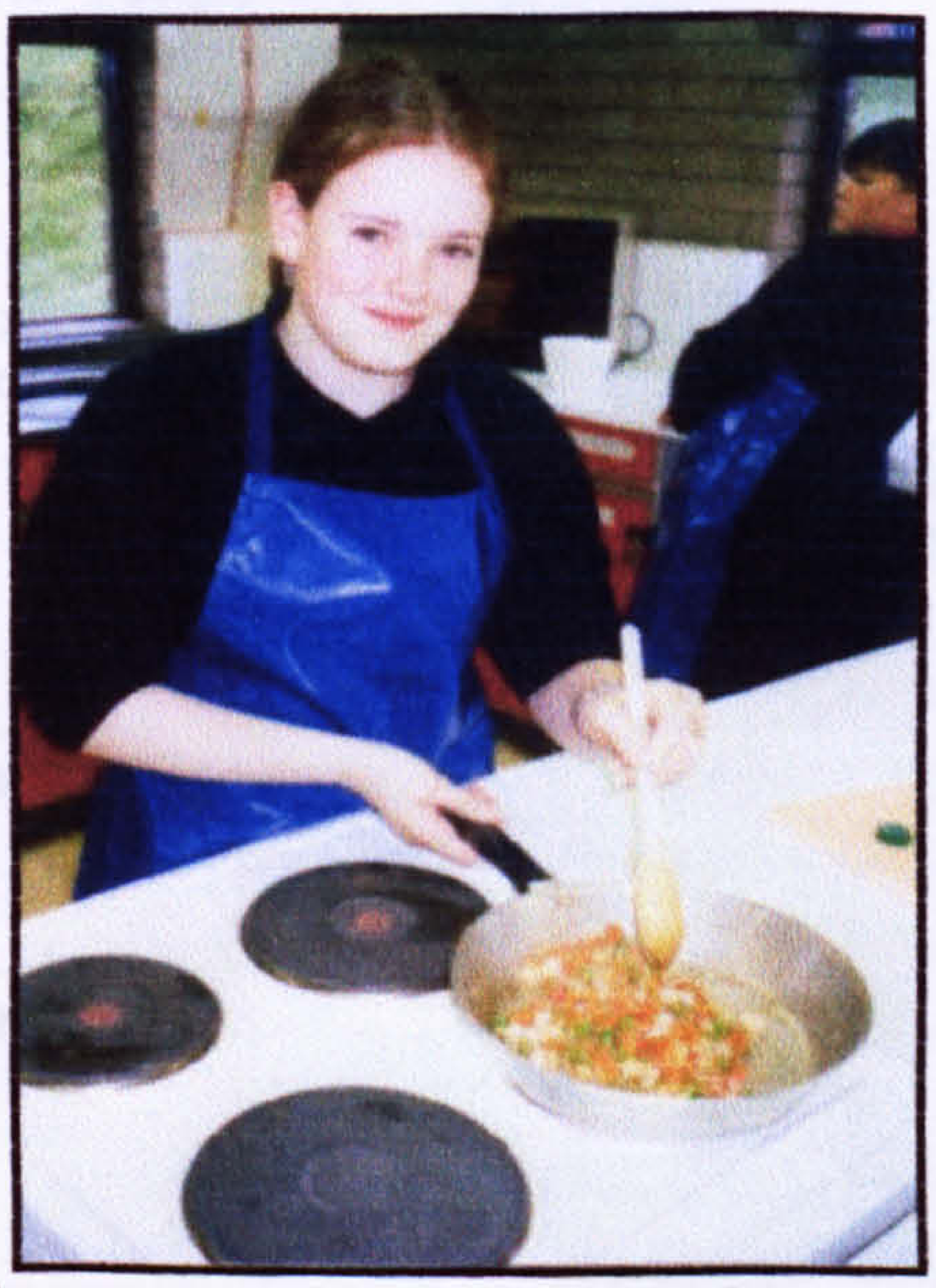
Plate 4.6 Making Food Club Pizza and Lasagne

It was a requirement of the cooking sessions to select recipes that did not require specialist or expensive equipment to prepare, in order that it might be possible for the children to repeat the recipes introduced at the Food Club at home. The complexity and the level of skills required to produce each dish increased over the duration of the Food Club. The variety of foods chosen to feature in the 20-week programme are shown Table 4.2 (Plate 4.6, Plate 4.7).

Table 4.2 Programme of practical work (weeks 1 – 20)

Week Number	Practical work: recipe 1	Practical work: recipe 2
1	Spud Fillers	Fruity Layers
2	Spiced vegetable parcels/pitta pockets	Fruit kebabs
3	Spicy potato wedges with tuna dip	Bananas with hot lemon sauce
4	Bacon and mushroom pasta	Sunflower crunchies
5	Scone twists	Fruit Punch
6	Egg salad and salad dressing	Garlic bread
7	Pizza	Flapjack
8	Bread and butter pudding	Spaghetti bolognese
9	Potato and pea curry with naan bread	Christmas baked apple
10	Christmas pud crunchies	Tangerine hedgehogs
11	Lasagne	Anzac crunchie
12	Sausage and mash with broccoli and sweetcorn	Fruit cheesecake
13	Vegetable chilli with rice	Museli
14	Tuna and sweetcorn pasta salad	Valentine biscuits
15	Sweet and sour chicken	Mixed bean salad
16	Sweet pancakes	Savoury pancakes
17	Fluffy omelette	Fruit sponge and custard
18	Vegetable stir fry	Fruit loaf
19	Food Club Pizza	Fresh fruit flapjack
20	Soda bread	Veggie burgers

Plate 4.7 Preparing a vegetarian curry at the Food Club



The design of the Food Club attempted to accommodate as many practical techniques as possible. Throughout the duration of the club, a range of basic cookery skills were demonstrated during each session, to be later practised by the children, with a main emphasis on basic skills during the first few weeks of the club. These basic skills were:

- accurate measuring of ingredients
- preparation of ingredients; washing, peeling, chopping, slicing, de-seeding etc
- correct use of weighing scales
- accurate measurement of liquids and powders
- methods: melting, folding, creaming, grilling, frying, beating, whisking, rubbing-in etc
- selection of appropriate herbs, spices, seasonings and garnishes
- selection of appropriate cooking times and temperatures

The club allowed enough time for two foods or dishes to be cooked during each session. The dishes used in the Food Club and the practical cookery skills associated with each dish are shown in Table 4.3 for Recipe 1 and Table 4.4 for Recipe 2.

Table 4.3 Recipe 1 (weeks 1 – 20) with required practical skills

Week Number	Practical work: recipe 1	Practical skills
1	Spud Fillers	Washing, chopping and slicing vegetables Using a main oven for baking Making a salad dressing
2	Spiced vegetable parcels/pitta pockets	Washing, chopping and slicing vegetables Rolling filo pastry Using radiant rings/gas burners Manipulating temperature controls Frying spices and vegetables
3	Spicy potato wedges with tuna dip	Preparing potatoes Assembling a dressing Using a main oven for baking
4	Bacon and mushroom pasta	Cooking pasta according to packet instructions Selecting dairy products for a simple sauce Using a garnish to enhance a dish
5	Scone twists	Using the rubbing-in method Rolling, shaping and cutting a dough

Table 4.3 (continued from Page 86)

6	Egg salad and salad dressing	Preparing salad vegetables Assembling a simple salad Making a salad dressing
7	Pizza	Assembling a pizza from prepared ingredients Using a main oven for baking
8	Bread and butter pudding	Making a custard sauce
9	Potato and pea curry with naan bread	Identifying spices and herbs Preparing chillies, garlic and fresh root ginger Preparing and boiling vegetables Preparing garlic and chillies
10	Christmas pud crunchies	Making small cakes using a melting method
11	Lasagne	Making a tomato-based bolognese sauce Making a roux-based with cheese
12	Sausage and mash with broccoli and sweetcorn	Cooking meat products appropriately to reduce the fat content Preparing and cooking a green vegetable
13	Vegetable chilli with rice	Preparing chillies and garlic Frying spices and vegetables Cooking rice according to packet instructions
14	Tuna and sweetcorn pasta salad	Cooking pasta according to packet instructions Assembling ingredients Making a salad
15	Sweet and sour chicken	Preparing chillies, garlic and fresh root ginger Cooking chicken appropriately and with care Using maize starch as a thickening agent
16	Sweet pancakes	Making a batter Assembling a filling
17	Fluffy omelette	Cracking and beating eggs Selecting seasonings Preparing additional ingredients
18	Vegetable stir fry	Washing, chopping and finely slicing vegetables Using high temperatures to cook vegetables quickly
19	Food Club Pizza	Making a basic bread dough Kneading a bread dough Rolling and shaping bread dough Making a tomato-based sauce Slicing and chopping vegetables Grating cheese
20	Soda bread	Making a bread dough Using a chemical raising agent

Table 4.4 Recipe 2 (weeks 1 – 20) with required practical skills

Week Number	Practical work: recipe 2	Practical skills
1	Fruity Layers	Using breakfast cereals, yoghurt and fresh fruit to create a healthy breakfast food
2	Fruit kebabs	Using fresh fruit to make an alternative kebab
3	Hot bananas with lemon sauce	Zesting and juicing citrus fruit Making a light sauce
4	Sunflower crunchies	Making biscuits using the melting method Including seeds to enhance nutritional value of a recipe
5	Fresh fruit smoothie, fruit punch	Using a blender appropriately and safely Peeling and chopping fresh fruit
6	Garlic bread	Making a garlic butter Using a main oven
7	Flapjack	Making biscuits using the melting method Folding in
8	Spaghetti bolognese	Cooking spaghetti according to packet instructions Making a tomato-based bolognese sauce
9	Christmas baked apple	Washing and coring apples
10	Grilled pineapple	Using tinned fruit to make a dessert Preparing and grilling fruit Using a grill Use of garnish to enhance a dish
11	Anzac crunchie	Making a biscuit mixture using a melting method Combining dry ingredients Folding in
12	Fruit cheesecake	Making a biscuit crumb base Whipping cream Folding in
13	Museli	Mixing dry ingredients Chopping nuts and dried fruit
14	Valentine biscuits	Making a basic sweet biscuit dough Rolling and cutting a biscuit dough
15	Mixed bean salad	Preparing onions and garlic Making a fresh salad dressing
16	Savoury pancakes	Making a batter
17	Fruit sponge and custard	Using tinned fruit to create a dessert Making a sponge using the creaming method
18	Fruit loaf	Making a cake using the creaming method
19	Fresh fruit flapjack	Making biscuits using a melting method Selecting suitable fresh fruits
20	Veggie burgers	Washing, preparing and chopping vegetables Using egg/breadcrumbs to form a coating

Plate 4.8 Choosing a healthy snack at the Food Club

4.8 Trying new and unusual foods at the Food Club

Towards the end of each session of the Food Club, the children were presented with the opportunity to try a food that was perhaps a new experience for them or was a relatively unusual food (Plate 4.8, Plate 4.9). The trying of new foods attempted to encourage the children to be adventurous in trying foods that were unfamiliar to them and to introduce an element of glamour to food. Exotic fruits were often included in these sessions. All the foods tasted by the children are presented in Table 4.5.

Plate 4.9 Trying porridge at the Food Club

Table 4.5 New and unusual foods provided at the Food Club (weeks 1 – 20) to sample

Week Number	Food tasted
1	Mango
2	Avocado
3	Granadilla
4	Nashi pear
5	Emerald sugar melon
6	Persimmon fruit
7	Mozzarella cheese
8	Pumpkin seeds
9	Water chestnuts
10	Japanese rice crackers
11	Raisin and cinnamon bagel
12	Lychees
13	Fortune cookies
14	Pine nuts
15	Oat biscuits
16	Plums
17	Rice cakes
18	Papaya
19	Kumquats
20	Sundried tomatoes

4.9 Data analysis

The attendance of all children and attendance by sex of the children to the Food Club were recorded by Mrs Tracey Cowell by a weekly register and obtained for analysis only once the Food Club sessions had finished in the Spring Term 2000. Qualitative data were obtained by Dr Rob Hyland through a series of individual interviews and focus groups conducted at mid-programme (after 10 sessions of the Food Club) and at the end of the Food Club programme (following 20 sessions of the club). For further information on the methodology of performing the qualitative and sociological analysis see Moynihan *et al*, 2001[b]. The focus groups were carried out using a sub-sample of the intervention group attending the Food Club and with a sub-sample of the parents of children attending the Food Club. The attendance data provided by Mrs Tracey Cowell were entered onto SPSS in order investigate the differences in attendance between the five schools of the intervention group and between boys and girls. The relationship between sustained attendance (number of weeks of attendance) to the Food Club and social deprivation were analysed using Spearman's correlation.

4.10 Results

4.10.1 Attendance to the Food Club

The median (and IQ range) of total attendance of boys and girls at the Food Club (by school unit) is shown in Table 4.6. The results of the analysis show that there was a non-significant tendency towards higher attendance by girls to the Food Club. The minimum number of sessions attended was 3 and the maximum 20. The median attendance of girls to the Food Club was shown to be greater than of boys, with three girls attending all 20 sessions of the Food Club. Forty-two children (of a possible 84) attended 15 sessions or more of the Food Club sessions. This is some 50% of the total group. The histogram in

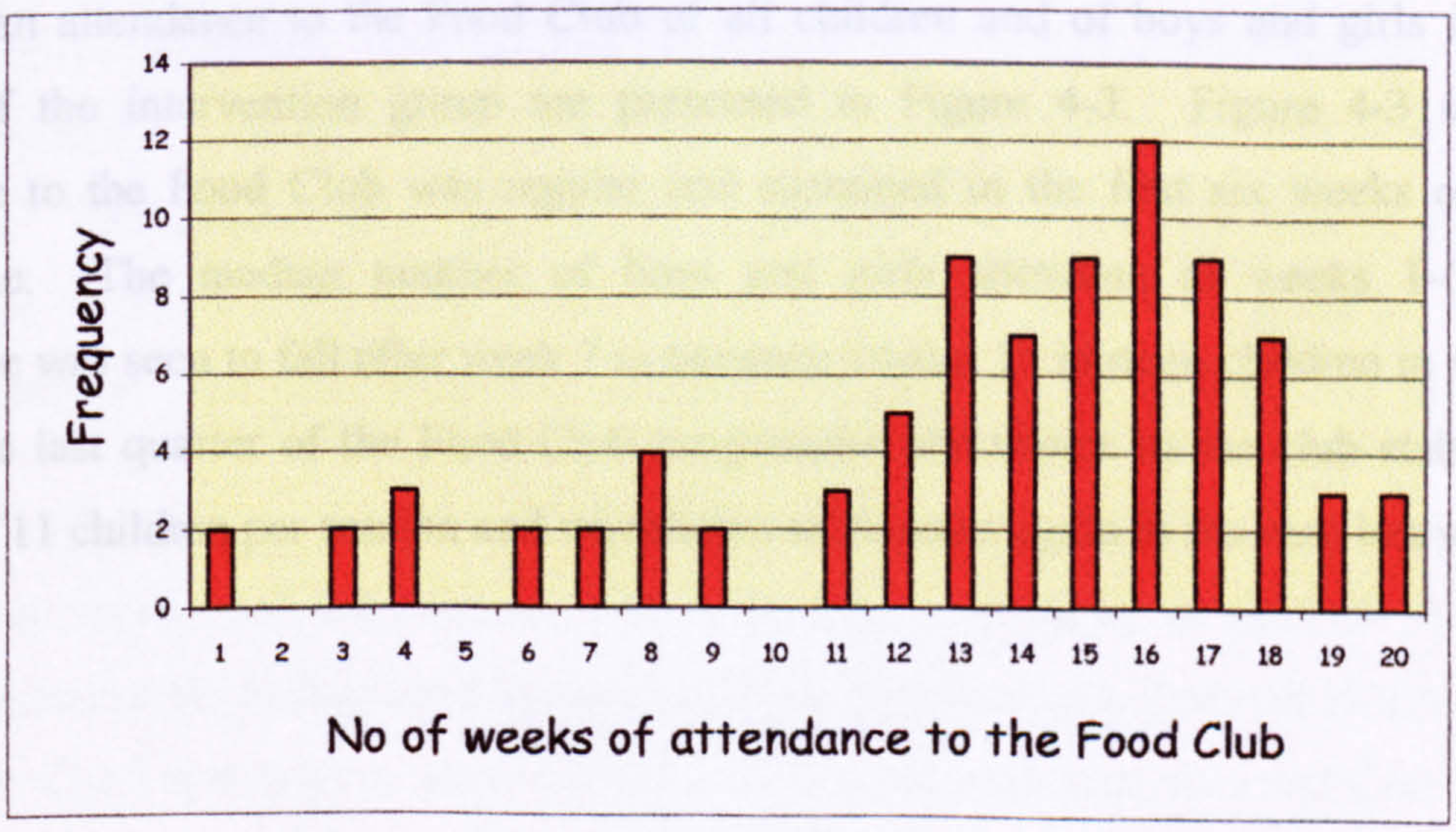
Figure 4-1 represents the frequency of attendance by all children in the intervention to the Food Club. Two pupils went to the Food Club only once and did not return. Seventeen pupils did not attend more than half of the sessions.

Table 4.6 Number of Food Club sessions attended by boys (*n*=31) and girls (*n*=53)

	Boys	Girls	All pupils	P value*
All schools	14 (4-20)	15 (3-20)	14 (3-20)	0.672
I1	11 (4-15)	13 (3-18)	13 (3-18)	0.098
I2	14 (7-18)	16 (12-20)	16 (7-20)	0.117
I3	12 (8-17)	13 (3-17)	13 (3-17)	0.244
I4	13 (7-20)	15 (13-17)	14 (7-20)	0.401
I5	16 (6-19)	16 (4-20)	16 (4-20)	0.772

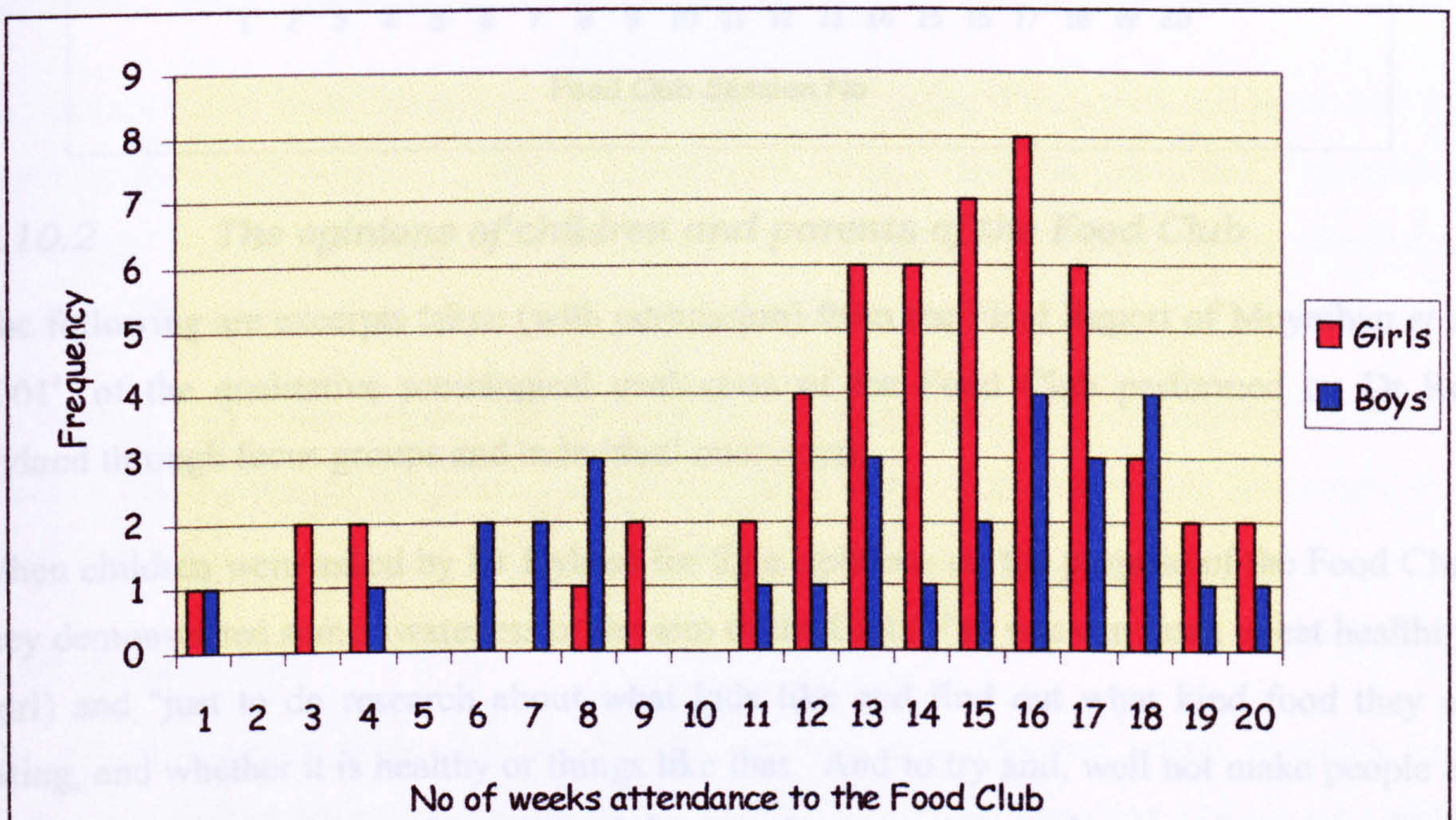
* Mann-Whitney test for differences between attendance by girls and boys

Figure 4-1 Frequency of attendance to the Food Club by all children (*n*=84) of the intervention group



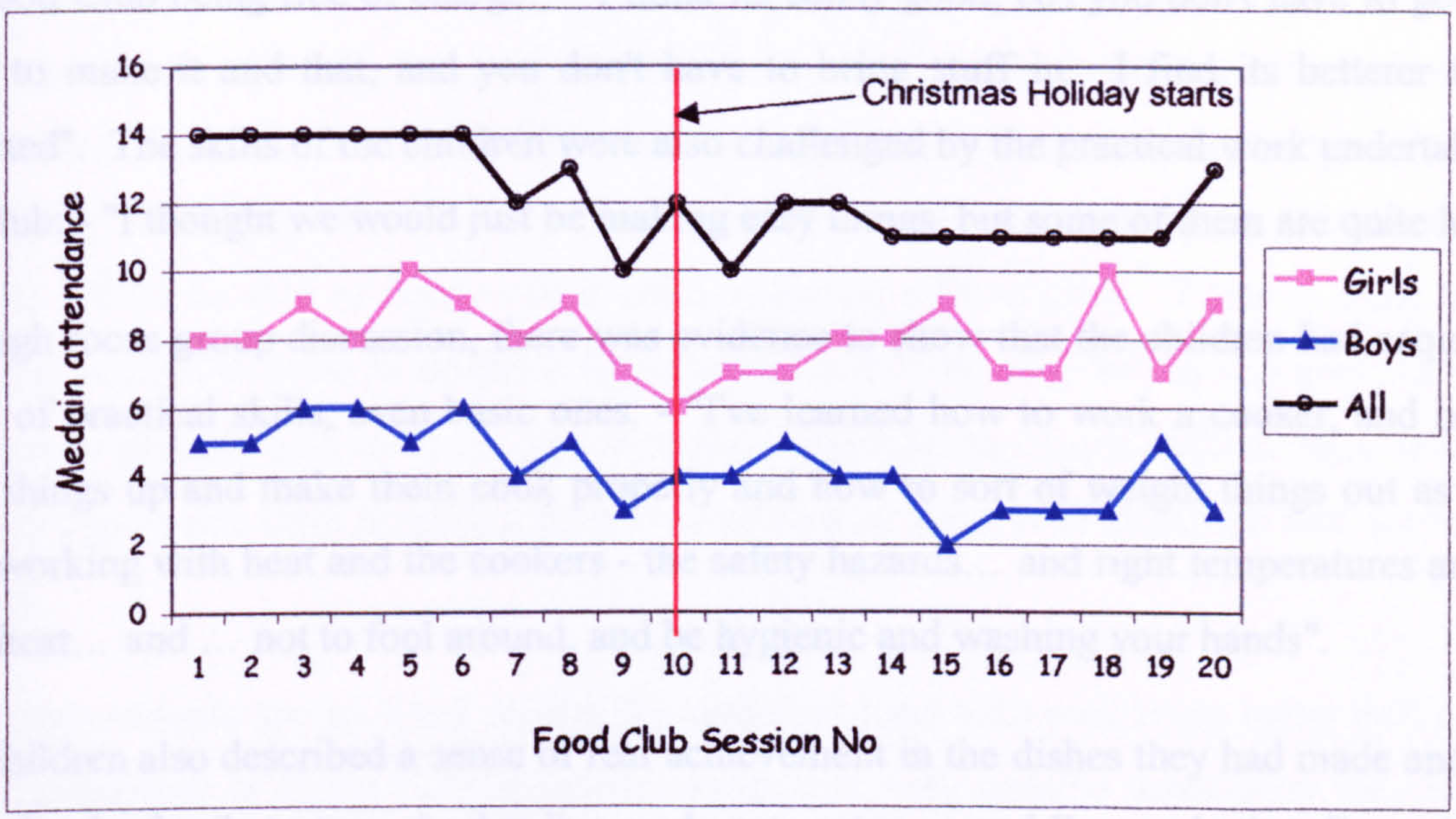
The histogram presented in Figure 4-2 shows the frequency of attendance to the Food Club by boys and girls in the intervention group and demonstrates the differences between the sexes in attendance to the club. One girl and 1 boy attended just one session of the Food Club. Four girls and 2 boys attended all 20 sessions of the club. Seven children attended 5 or less sessions of the club. These five weeks of attendance are equivalent to about one half-term in the academic school year. Figure 4-2 shows that a higher number of girls attended the club for a greater number of sessions than did boys. Sixty-seven children attended 10 or more sessions of the club.

Figure 4-2 Frequency of attendance to the Food Club of children in the intervention group by boys (*n*=31) and girls (*n*=53)



The median attendance to the Food Club of all children and of boys and girls in the five schools of the intervention group are presented in Figure 4-3. Figure 4-3 shows that attendance to the Food Club was regular and sustained in the first six weeks of the club programme. The median number of boys and girls attending in weeks 1-6 was 14. Attendance was seen to fall after week 7 to between 10 and 13 thirteen children in weeks 7 to 14. In the last quarter of the Food Club programme attendance to the club stabilised at a median of 11 children per session and was shown to increase again in the very last week.

Figure 4-3 Median attendance of boys, girls and all children (n = 84) in five intervention group schools to the Food Club sessions (No 1 - 20) by session



4.10.2 *The opinions of children and parents of the Food Club*

The following are excerpts taken (with permission) from the Final Report of Moynihan *et al*, 2001[a], of the qualitative sociological evaluation of the Food Club performed by Dr Rob Hyland through focus groups and individual interviews.

When children were asked by Dr Hyland for their opinions on the purpose of the Food Club, they demonstrated some awareness of the aim of the Club; -"so you can learn to eat healthily" (girl) and "just to do research about what kids like and find out what kind food they are eating, and whether it is healthy or things like that. And to try and, well not make people eat them, but to learn children how to cook healthy foods so they go home and cook them and start eating them". Others had different perceptions; - "to give the kids summat to do after school when they're bored". The children were positive in their descriptions of the Food Club and referred to the Club as "mint", "class, stylish and out of this world" and "Cool, brilliant. Not swotty". The children also thought that, because the Food Club was held in the evenings after school, "it gets you out of the house on a night cos you get sick of being in" and it "just takes up some of your time when you wouldn't have been doing nothing, just sitting in the house".

The children appreciated the informal style of the Club and the opportunity to cook in less-pressured circumstances than food lessons in school. For example, "you get to time to cook it in the Food Club" and "you've got to rush at school… where like at the Food Club you've got till half past five and that doesn't pressurise us". The children also recognised the benefits of the Food Club being free of charge: - "I think its canny good, cos you don't have to get your stuff, to make it and that, and you don't have to bring stuff in. I find its betterer than I expected". The skills of the children were also challenged by the practical work undertaken at the Club: - "I thought we would just be making easy things, but some of them are quite hard".

Through focus group discussion, there was evidence to show that the children had acquired a range of practical skills, even basic ones: - "I've learned how to work a cooker, and how to chop things up and make them cook properly and how to sort of weight things out as well" and "working with heat and the cookers - the safety hazards... and right temperatures and the right heat... and ... not to fool around, and be hygienic and washing your hands".

The children also described a sense of real achievement in the dishes they had made and took home for the family to try: - ".what I've made gets eaten,... and I've made that, I've achieved something" and on the reactions of the family: - "They're canny chuffed and I'm chuffed cos I've done it".

For further and more detailed information on the qualitative analysis of the opinions of children and parents of the Food Club, please refer to the Final Report of Moynihan *et al*, 2001[a].

4.11 Discussion

The attendance data show that the Food Club was well-attended which provides some evidence of the children's enjoyment of the Club. The median attendance of the all children to the Food Club was 14 weeks and that 50% of the final sample had attended 15 or more weeks of the Club. The data show that that there were no significant differences between attendance by girls and attendance by boys. This in itself suggests that the Food Club was equally appealing to both sexes and the balance of activities and practical work was sufficient to engage boys of this age as well as girls and the data demonstrate some considerable commitment on the part of the children. Median attendance by all children to the Food Club was seen to fall slightly after week 9 until week 11. Weeks 9 and 10 of the Food Club correspond to the last two weeks of the autumn term before the children finished at school for Christmas holidays. This period of the year is notorious for the disruption to the academic timetable by festive activities and it is likely that this had a small affect on the children's ability to attend to the Club. Further examination of the attendance data show that the Club was well attended in the first six weeks and in the last 7 weeks. It is possible that several short blocks of six weeks or so duration may be suitable programme for further Food Clubs. All costs of running of the Food Club were met by the project budget - neither schools nor children were asked to contribute. This may have some bearing on the popularity of the Club, particularly in children from socially deprived backgrounds where it cannot be assumed that families would be able to finance their child attending a Food Club. There is some further research required in order to establish how future Food Clubs may be run and how schools or community groups could meet the cost in terms of ingredients. Some children may be able to bring in ingredients from home but there may always be some who cannot do this, for various reasons.

Secondary schools are an ideal setting for practical food activities since many will have a Food Technology or Home Economics classroom that, with suitable permission, may be used as a base for a Food Club. The teaching of future Food Clubs would inevitably rely on the goodwill of teachers of Food Technology/Home Economics as professionals accustomed to dealing with children of this age, possessing satisfactory police clearance to work with young people and of course considerable experience in the teaching of practical food skills.

When considering the feasibility and transferability of Food Clubs in future research studies or in community-based projects it would be advisable to conduct focus groups with teachers of practical food skills in addition to children themselves. This would be an effective method of identifying potential problems in terms of budget and the leadership of the Club. Children should be given the opportunity to air and discuss their perceptions of the importance of practical food skills and what they would expect to happen at an after-school Food Club. Focus groups or questionnaires with teaching staff (or youth workers) would provide an insight into the potential problems. Focus groups with teachers have been shown to be valuable in the development of school-based nutrition education programmes (Kicklighter *et al*, 1997) and may provide useful suggestions when considering the practical setting up of an after-school Food Club. The work of Dr Rob Hyland (Moynihan *et al*, 2001[a]) shows that the response of the children to the Food Club was overwhelmingly positive and that the children had thoroughly enjoyed cooking at the Club. The Food Club was also viewed as a social occasion, the value of which should not be underestimated. Further work which explores the views and attitudes of schools towards the development and running of an after-school Food Club may be extremely important in guaranteeing the future success of similar Clubs.

Top Ten Tips If You Need to Loose Weight

☺ Cut down on foods containing fat and foods containing sugar

☺ Choose healthy snacks: vegetable sticks, fruit, bread sticks, plain popcorn

☺ Try taking some fruit with you when you leave the house, banana and apples are easy to eat when you need a snack

☺ Enjoy regular activity like walking, cycling, dancing, swimming, roller blading

☺ Always eat some breakfast cereal with semi-skimmed or skimmed milk, this will stop you feeling hungry during the morning

☺ Don't cut out starchy foods like bread, other cereals and potatoes as these give you B vitamins, as well as calcium and iron. They are filling and lower in calories than foods containing fat

☺ Use thick bread for sandwiches with a low fat filling like tuna with lots of salad

☺ Don't cut out dairy foods like milk and cheese - as you grow your bones need the calcium in these foods. Try the lower fat versions like skimmed milk, low fat yoghurt and reduced fat cheeses as they still contain the calcium but less fat

☺ If you eat a little chocolate, sweets, or crisps this is not the end of the world. All these foods are part of getting the balance right, but try not to eat them too much or too often

☺ Hide the bathroom scales, just focus on how good you feel to be enjoying a varied diet and being active

www.lifebytes.gov.uk/eating/eat_weight.html
Healthy lifestyles website for young people

5.1 Introduction

Anthropometry, that is, the measurement of body height and weight and of body dimension and proportion, is widely considered to be an intrinsic part of any nutritional study since it is used as an indices of health, growth and development (Department of Health, 1991, Zemel *et al*, 1997). In addition, anthropometric measurements may be used as part of the nutritional assessment of infants and children (Mascarenhas *et al*, 1998). Further calculations employing the basic measurements are used to determine derived indices, for example to assess that proportion of the body weight which is fat, can be extremely useful in procuring additional information on either individuals, or groups of individuals.

In the clinical setting anthropometric measurement of infants and young children is performed as part of nutritional assessment, either as a routine measurement or in children who present with disease that may have had or be having an affect upon their dietary intake or growth and development. Is it general practice in the Primary Care setting within the UK to monitor the height and weight of infants in accordance with age to enable the health professional to make comparisons with normative growth charts (revised in 1995) to identify a failure to thrive. In addition to height and weight, many other body measurements of both infants, children and adults may be recorded, the following of which are examples: head circumference (an indication of normative growth in infants), upper arm length and lower leg growth (to determine skeletal growth and deformities), mid-upper arm circumference (to provide information on body size) and ratio of waist to hip circumference (to estimate distribution and location of body fat).

Interpretation of anthropometric data becomes more difficult as children approach and pass through their adolescent years. This is because much natural variation occurs within pre-adolescents and adolescents in terms of when and how they grow and entering puberty. This is considered to be a combination of many different factors, including those relating to genetics, medical illness, diet and lifestyle. Therefore, it is necessary to bear in mind the occurrence of variation when investigating the anthropometry of older children and teenagers.

Height and weight are measurements used to determine basal metabolic rate in children and adults. Approximately two-thirds of the energy a person spends in any one day supports the body's metabolic activities. In addition to metabolic activity, energy is required to support physical activity and for the digestion and metabolism of food (also referred to as the thermic affect of food). The estimation of basal metabolic rate is usually straightforward in healthy individuals and forms the basis for the determination of energy requirements for a given group of individuals within the population. The estimation of energy requirements for children and adolescents are based upon the use of basal metabolic rate, using the calculation equations devised by Schofield (1985), in conjunction with data compiled on the daily physical activities (in terms of the energy required to support these activities) of children aged 10-18-years-old, culminating in guidance on estimates of average requirements for energy for this group of the population. Estimated Average Requirement of energy for children relies upon the use of Physical Activity Ratios (projected from data on energy expenditure by children) with an additional allowance for energy required to support growth. This is reflected in the factor of 1.56 x BMR for boys and in the factor of 1.48 x BMR for girls to calculate energy requirements (Department of Health, 1991) and is expressed in MJ/day. Superficially, values that are much higher or lower than this may suggest a deficit of energy intake or an excess respectively. As such, it is wise to consider variance between individuals within any one group when making conclusions about the recorded energy intake of children and adolescents as measured in a dietary survey.

Body Mass Index (BMI) is used an index of an individual's weight in relation to height and is determined by dividing body weight (kg) by the square of the height (m^2). BMI is also used as an indicator of body fatness and is often used to assign correlation with disease risk. An inherent weakness associated to the use of BMI is that a person may figuratively appear to be overweight or indeed obese when this is not so. An example of this may be a sportsman or athlete with dense bones and well-developed muscles.

BMI is used with a caution in older children and adolescents as the relationship of BMI to body composition is influenced by several factors among which are age, sex, race and stage of pubertal development. This is exemplified in the work of Bini and colleagues (2000) who reported that BMI values determined for subjects (n = 6345) aged between 8- and 16-years-old were dependent upon pubertal degree of maturation and this affect was significantly more evident in girls.

The age of menarche is recognised as being an indicator of pubertal status. In the UK the average age of menarche has been steady since the mid 20th Century. The average age of menarche in British girls in 1950's was 13 years and six months and slight decrease in the average of menarche was reported by Whincup *et al* (2001), falling to 12 years 11 months.

Whincup *et al* reported on a cardiovascular health study of 1166 British girls aged 12-16-years-old and presented data on median menarcheal age of girls. Median menarcheal age was not found to differ significantly by social class or race but Whincup *et al* reported that amongst the study sample, 12% of girls indicated that they had had their first menstrual period before leaving primary school. The age of menarche is recognised to be influenced by several factors, for example, the maternal age of menarche and body weight. In view of the influence of body weight upon the onset of puberty and menstruation, this has the potential to impact upon the body composition of girls and introduces the need for caution when interpreting anthropometric data without information on the pubertal status of female subjects. BMI has been successfully used as an outcome variable in previous health interventions in the school setting (Manios *et al*, 1999).

The incidence of obesity in the UK is rising. The Department of Health figures of 1998 reported that 21% of women and 17% of men were obese (Department of Health, 1998). As obesity in childhood and adolescence is now currently accepted to be linked to predisposition to obesity in adult life (Power & Parsons, 2000), the BMI of older children and adolescents can provide a useful tool in identifying those young people most at risk.

The collecting of anthropometric measurements were deemed necessary for this study in order to validate mean energy intake. It was also recognised that by calculating body mass index along with basal metabolic rate, the data may show some indication of body fatness and obesity in the study group.

5.1.1 Aims

The specific aims were to:

- measure the weight (kg) and height (m) of the children
- apply measurement of height and weight to calculate: Basal Metabolic Rate using a calculation method appropriate to children aged 11-13 years old, the Body Mass Index (BMI) of the children and the Physical Activity Level (PAL) using a calculation method appropriate to children aged 11-13 years old.

- **Investigate the relationship between the anthropometric data and social deprivation**

5.2 Methods

5.2.1 Measurement of height and weight

Anthropometric measurements were conducted at baseline and post-intervention, in the subjects' home, or, where necessary, in the office of the School Nurse at school to ensure privacy for the children.

All subjects were measured with a wall-fixed measuring tape wearing socks but with shoes removed. Subjects were asked to stand with their feet approximately 25-30cm apart, maintaining a straight posture with arms hanging loosely against their sides, and instructed to breath in deeply before the measurement was taken. Height was measured to the nearest 0.5cm, this deemed to be the minimum level of accuracy obtainable with this standard of equipment. All measurements were recorded with children wearing light indoor clothing

The weight of the subjects was recorded using SALTA scales. Subjects were asked to remove shoes, outdoor jacket, school blazer and jumper and also to remove the contents of pockets. Subjects were asked to stand with feet together and a reading taken once the instrument reading had settled and weight recorded to the nearest 0.5kg (deemed to be the most acceptable level of accuracy on sprung scales without weight specific calibration).

5.2.2 Calculation of Basal Metabolic Rate

The weight (kg) of each child was used to calculate BMR using Schofield equations (Schofield, 1985) for children aged 10 to 18 years. The Schofield equations to calculate BMR for boys and girls are shown below.

- **Boys**

Basal Metabolic Rate (MJ) = (0.074 x weight (kg)) + 2.754

- **Girls**

Basal Metabolic Rate (MJ) = (0.056 x weight (kg)) + 2.898

The time of day at which measurements were taken were noted at phase T0 in order that measurements recorded at phase T1 would concur.

5.2.3 *Calculation of Body Mass Index*

The height and weight of each child was used to calculate Body Mass Index thus:

Body Mass Index (BMI) = weight (kg)/[height (m^2)]

5.2.4 *Calculation of Physical Activity Level (PAL ratio)*

BMR and average estimated energy intake from the children's dietary diaries (mean daily energy intake MEI MJ/day) were used to calculate the ratio BMR:MEI expressed as the physical activity level (PAL). This calculation was referenced to the recommended PAL for children aged 11-13- years old and used as a validation measure.

5.2.5 *Analysis of anthropometric data*

All anthropometric data were entered onto the study database and, when the collection of anthropometric measurements completed for each school unit, the heights and weights of all subjects were transferred onto a Microsoft Excel spreadsheet to enable calculations of BMR, BMI, and PAL to be performed using formulae outlined in Sections 5.2.2, 5.2.3, and 5.2.4. Subsequently the data were entered onto SPSS v.10. Mean (SD) of height, weight, BMR, BMI and PAL were determined for all subjects in the intervention and control group.

The mean change (SEM) in height, weight, BMR, BMI and PAL were determined for all subjects. The groups were further divided by sex in order for comparisons to be made on the basis of recognising variation in pubertal state between girls and boys of this age group. Differences between groups in anthropometric data were investigated using t-test. The possible relationship between social deprivation (Townsend score) and the height, weight and BMI of all children were examined using Pearson's Rank Correlation.

5.3 Results

Anthropometric measurements were taken from 162 children (80 in the intervention group and 82 in the control group) of the 167 children completing all aspects of the study. Five subjects declined to be weighed. The mean (SD) of height, weight, BMR, BMI and PAL of all children in the intervention and control groups at baseline are displayed in Table 5.1. Similar data recorded at post-intervention (T1) are shown in Table 5.2. The distribution of the weight of children in the intervention and control groups at baseline and post-intervention are displayed in Figure 5.1 and Figure 5.2. There were no significant differences in height, weight, and BMR between children in the intervention and control group at baseline. A non-significant tendency towards a slightly higher body mass index could be observed in children in the intervention group.

Table 5.1 Mean (SD) of height (cm) and weight (kg), BMR (MJ), BMI and PAL of children in the intervention group and control group at baseline (T0)

	Mean (SD) Intervention (n=80)	Control (n=82)	P value*
Height (cm)	152 (8.0)	154 (8.8)	0.226
Weight (kg)	50.7 (12.0)	49.3 (11.6)	0.380
BMR (MJ)	6.0 (0.8)	5.9 (0.7)	0.499
BMI	21.8 (4.1)	20.7 (4.2)	0.093
PAL	1.5 (0.4)	1.5 (0.4)	0.980

*t-test of differences between intervention and control group

There were no significant differences in height, weight, and BMR between children in the intervention and control group at baseline. A non-significant tendency towards a slightly higher body mass index could be observed in children in the intervention group.

Figure 5-1 Distribution of weight (kg) of children in the intervention group (n=80) at baseline and post-intervention

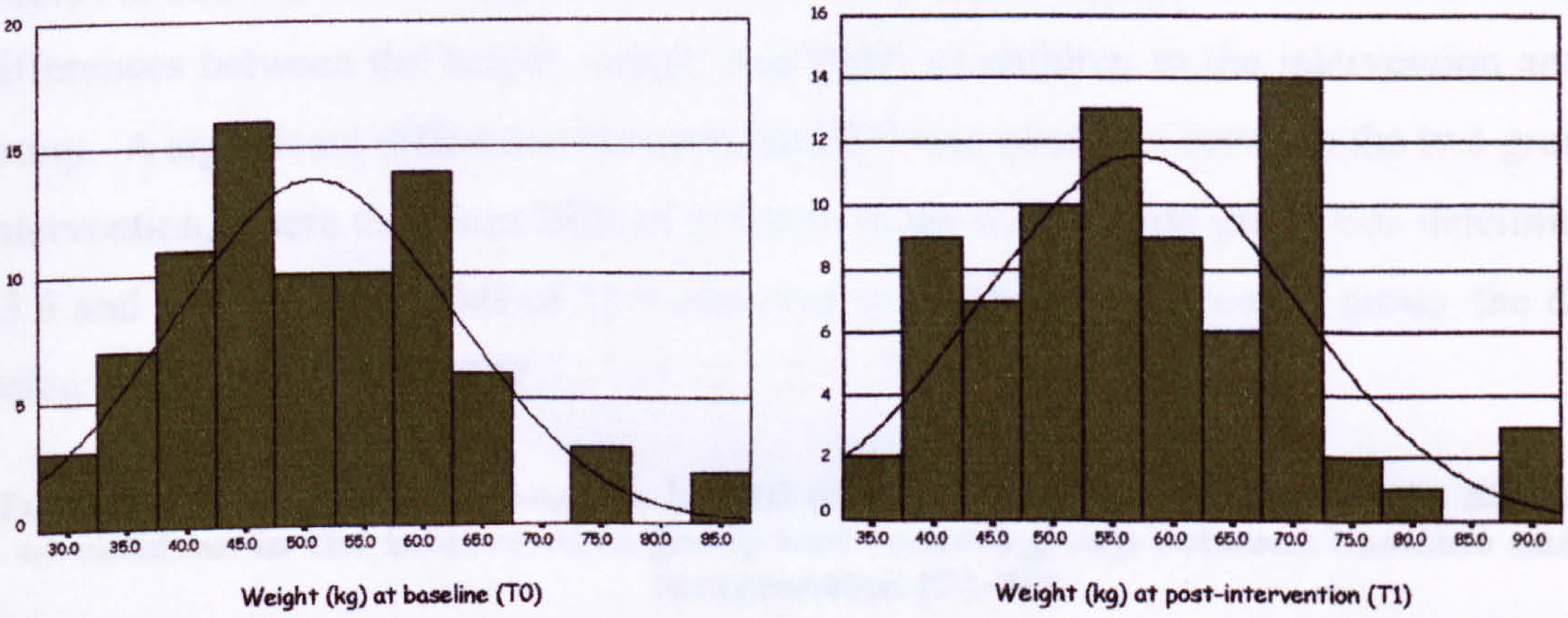
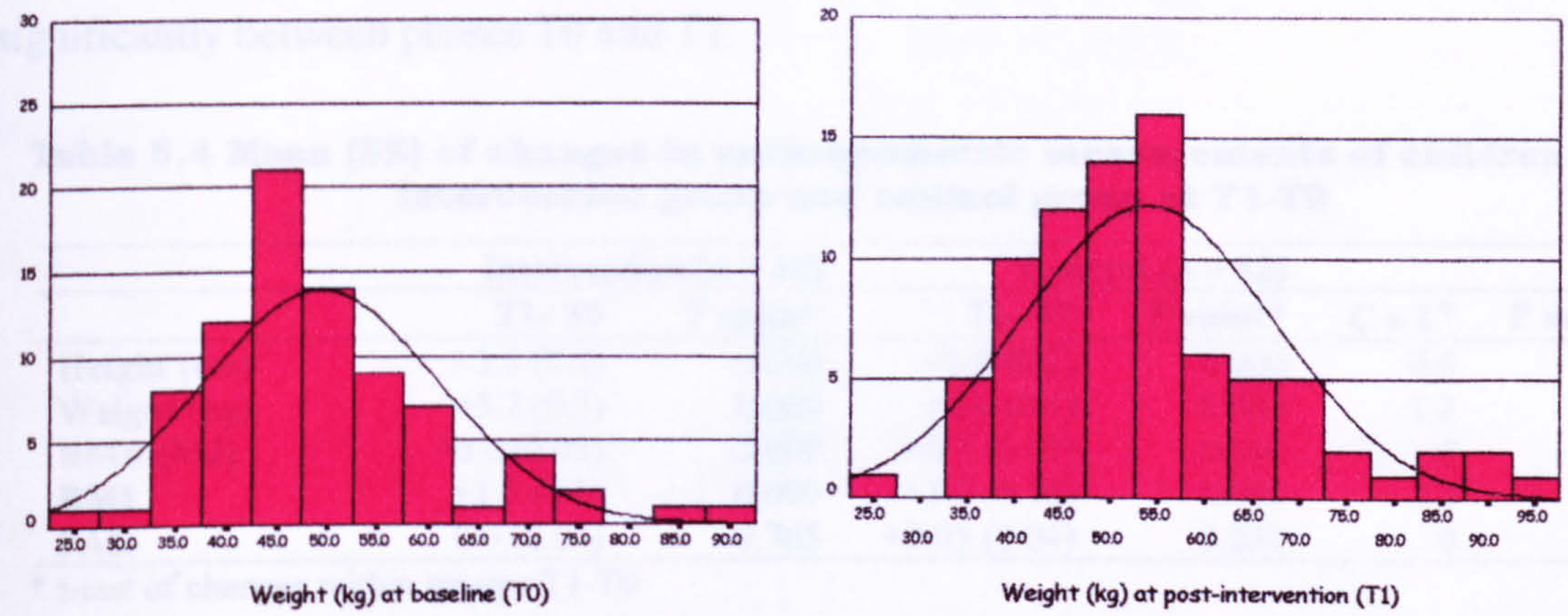


Table 5.2 Mean (SD) of height (cm) and weight (kg), BMR (MJ), BMI and PAL of children in the intervention group and control group at post-intervention (T1)

	Mean (SD) Intervention (n=80)	Control (n=82)	P value*
Height (cm)	155 (8.4)	157 (9.4)	0.351
Weight (kg)	57.1 (13.1)	53.9 (13.3)	0.117
BMR (MJ)	6.4 (0.9)	6.2 (0.9)	0.406
BMI	23.6 (4.2)	21.9 (4.6)	0.027
PAL	1.5 (0.4)	1.5 (0.4)	0.541

*t-test of differences between intervention and control group

Figure 5-2 Distribution of weight (kg) of children in the control group (*n*=82) at baseline and post-intervention



The changes in anthropometric measurements of all children in the intervention and control group are presented in Table 5.3 .The distribution of the height of the children was close to normal and median values were observed to be close to mean values. Between groups, no significant differences in the mean height of children was observed at baseline, post-intervention or in the increase in height between baseline and post-intervention (see Table 5.1, Table 5.2 and Table 5.3). Post-intervention measurements show that there were no significant differences between the height, weight and BMR of children in the intervention and control group. A significant difference between the BMI was observed between the two groups post-intervention, where the mean BMI of children in the intervention group was determined to be 23.6 and a lower mean BMI of 21.9 observed in children in the control group, the difference being significant at $P = 0.027$.

Table 5.3 Mean (SE) of change in height (cm) and weight (kg), BMR (MJ), BMI and PAL of children in the intervention group and control group between baseline and post-intervention (T1-T0)

	Mean (SE)		
	Intervention (*n*=80)	**Control (*n*=82)**	**P value***
Height (cm)	+3.5 (0.2)	+2.9 (0.02)	0.081
Weight (kg)	+5.7 (0.5)	+4.6 (0.4)	0.086
BMR (MJ)	+0.4 (0.01)	+0.3 (0.02)	0.677
BMI	+1.4 (0.2)	+1.2 (0.1)	0.396
PAL	+0.07 (0.04)	+0.04 (0.04)	0.567

*t-test of differences between intervention and control group

Table 5.3 shows a non-significant tendency towards a greater increase in both height and weight in children of the intervention group between baseline and post-intervention. A mean growth of 3.5 cm was observed in the intervention group and a mean growth of 2.9 cm observed in control group children. Changes in the anthropometric data of the intervention and control group children are displayed in Table 5.4 where, within groups, height increased significantly between phases T0 and T1.

Table 5.4 Mean (SE) of changes in anthropometric measurements of children in the intervention group and control group at T1-T0

	Intervention (n = 80)		Control (n = 82)			
	T1- T0	P value*	T1- T0	P value*	C v I$^{\psi}$	P value**
Height (cm)	+3.5 (0.2)	0.000	+2.8 (0.2)	0.000	0.6	0.081
Weight (kg)	+5.7 (0.5)	0.000	+4.6 (0.4)	0.000	1.2	0.086
BMR (MJ)	+0.4 (0.03)	0.000	+0.3 (0.02)	0.000	0	0.677
BMI	+1.5 (0.2)	0.000	+1.2 (0.16)	0.000	0.2	0.396
PAL	0.0 (0.04)	0.765	+0.05 (0.04)	0.234	0	0.567

* t-test of changes within groups T1-T0

** t-test of changes between intervention and control group

ψ mean difference in differences between intervention and control group (control group value minus intervention value)

The data show that significant growth took place in both groups between phases T0 and T1 and a similar increase in body weight was also demonstrated within both groups. Correspondingly, mean BMR and BMI values demonstrate further the growth of the children within the one-year period between anthropometric measurements. PAL values were observed to be similar for both groups at both phases of the study and no significant difference determined within groups between baseline and post-intervention. The measurements of children in the intervention and control groups are shown in Table 5.5.

At baseline, the mean height of boys and girls in the intervention group was 153 cm and 152 cm respectively. The mean height of boys in the control group at baseline was 154 cm and girls 153 cm. At T1, slight differences in height between the sexes became apparent, where mean height of boys in the intervention group was 156 cm and the mean of height of girls 154. Similarly, in the control group, the mean height of boys at T1 was 158 cm and girls 156 cm. At baseline and post-intervention, girls in both groups were found to be heavier than boys. In both groups, for boys and for girls, growth, increases in weight, BMR and BMI were found to be significant between baseline and post-intervention. At baseline, 27 children; 21 girls and 6 boys (17% of the total study sample) had a BMI greater than 25. At baseline, the BMI of six children was calculated to be greater than 30. At post-intervention, the percentage of children with a BMI greater than 25 increased to 26% (42 children, of which 13 were boys and 19 girls). At phase T1, 13 children had a BMI greater than 30.

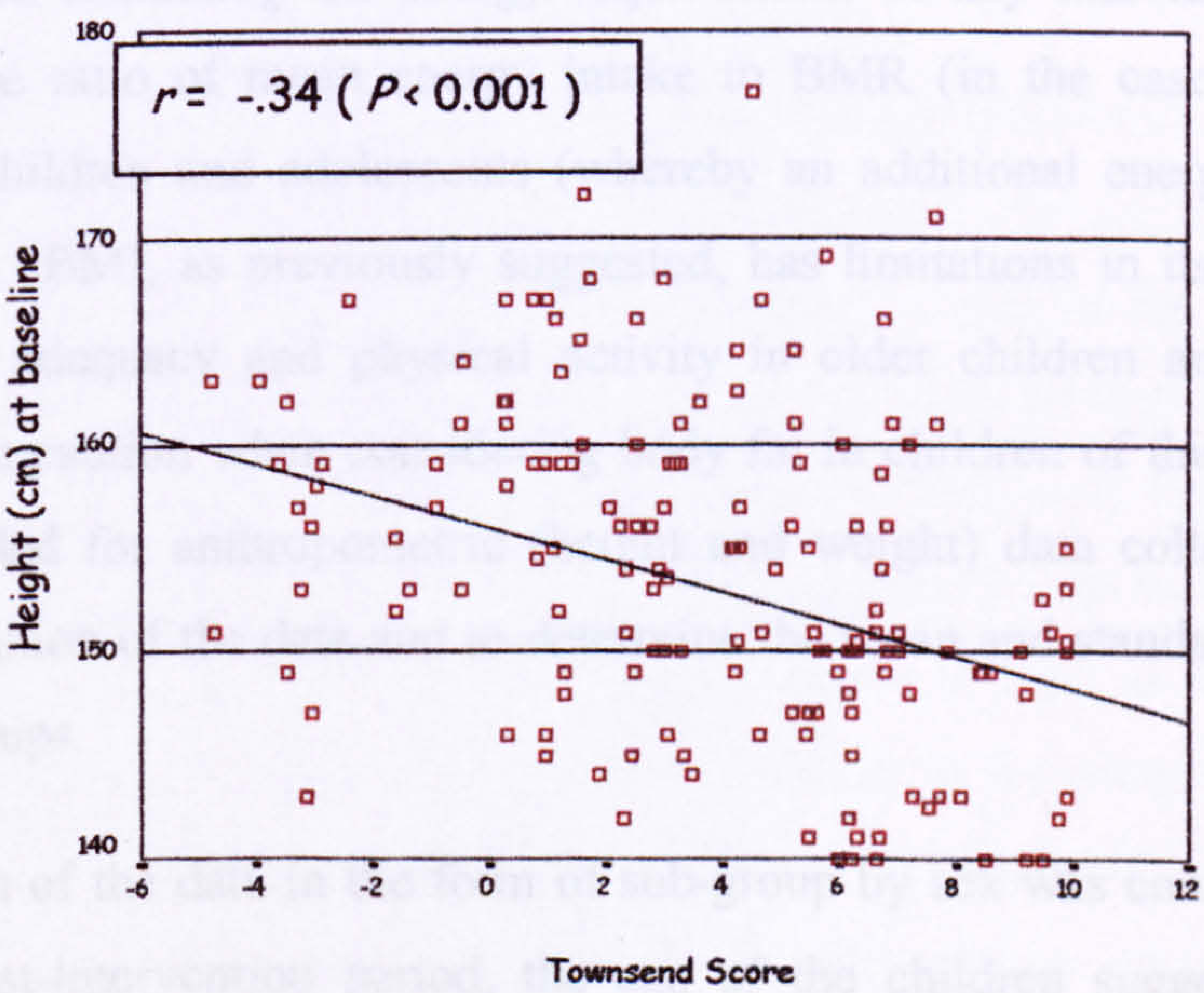
Table 5.5 Mean (SD) of anthropometric measurements of boys and girls in the intervention group and control group at baseline (T0), post-intervention (T1) and mean (SE) of change within groups (T1-T0)

	Intervention Group (n = 80)				Control Group (n = 82)			
	T0	T1	T1- T0	P value *	T0	T1	T1- T0	P value *
Height (cm)								
Boys	153 (8.2)	156 (8.6)	+4.1 (0.4)	0.000	154 (7.9)	158 (9.2)	+3.3 (0.5)	0.000
Girls	152 (7.8)	154 (8.3)	+3.5 (0.3)	0.000	153 (9.4)	156 (9.6)	+2.6 (0.2)	0.000
Weight (kg)								
Boys	49.8 (10.6)	56.7 (12.5)	+5.9 (0.7)	0.000	48.6 (10.8)	53.8 (11)	+5.2 (0.7)	0.000
Girls	51.6 (12.8)	57.3 (13.7)	+5.6 (0.8)	0.000	49.7 (12.2)	56.9 (14.)	+4.2 (0.6)	0.000
BMR (MJ)								
Boys	6.4 (0.8)	6.9 (0.8)	+0.4 (0.05)	0.000	6.4 (0.8)	6.7 (0.8)	+0.4 (0.05)	0.000
Girls	5.8 (0.7)	6.1 (0.8)	+0.3 (0.04)	0.003	5.7 (0.7)	6.0 (0.8)	+0.2 (0.03)	0.000
BMI								
Boys	21.3 (3.8)	23.1 (3.9)	+1.2 (0.4)	0.002	20.2 (3.8)	21.5 (3.7)	+1.3 (0.2)	0.000
Girls	22.1 (4.3)	23.8 (4.4)	+1.6 (0.3)	0.000	21.0 (4.4)	22.1 (5.0)	+1.1 (0.2)	0.000
PAL								
Boys	1.56 (0.4)	1.58 (0.4)	+0.01 (0.06)	0.786	1.60 (0.3)	1.61 (0.3)	+0.03 (0.06)	0.574
Girls	1.40 (0.4)	1.41 (0.4)	+0.01 (0)	0.852	1.39 (0.4)	1.45 (0)	+0.05 (0)	0.295

* t-test of changes within groups

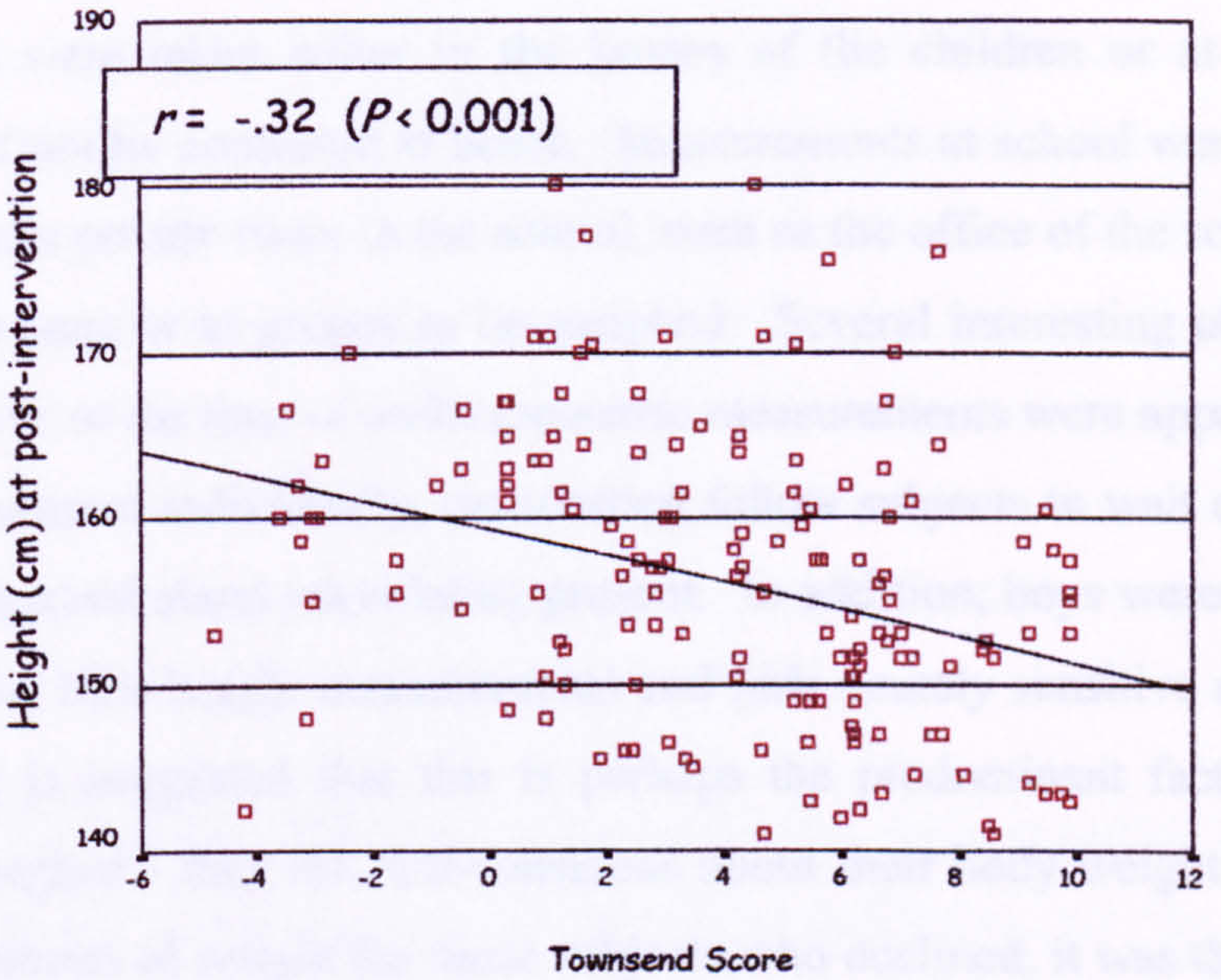
The relationship between Townsend score and the weight, BMR, and BMI of all children participating in the study was investigated using Pearson's correlation but did not reveal a relationship of statistical significance. The relationship between Townsend score and height in all subjects was found to be negative and significant at both baseline (T0) (see Figure 5-3) and this relationship persisted to the post-intervention measurement period (see Figure 5-4).

Figure 5-3 The relationship between Townsend Material Deprivation Score and height (cm) at baseline (T0) of 162 children



A small but significant negative correlation between the Townsend score of children and their height (cm) was observed at baseline (where $r = -.341$, $P<0.001$). Figure 5-4 shows a similar significant negative tendency towards a decrease in height concomitant with a higher Townsend score at post-intervention (where $r = -.317$, $P<0.001$).

Figure 5-4 The relationship between Townsend Material Deprivation Score and height (cm) at post-intervention (T1) of 162 children



5.4 Discussion

The main aim of collecting anthropometric measurements from the children participating in this study was to enable the calculation of primarily BMR and secondly BMI. The former indices is integral in estimating the energy requirements of any individual and is used to further calculate the ratio of mean energy intake to BMR (in the case of adults) and to calculate PAL in children and adolescents (whereby an additional energy requirement for growth is allowed). BMI, as previously suggested, has limitations in its application to the assessment of diet adequacy and physical activity in older children and adolescents and should be used with caution when considering body fat in children of this age. No detailed analysis was intended for anthropometric (height and weight) data collated, other than to examine the distribution of the data and to determine the mean and standard deviation for all subjects and for groups.

Further presentation of the data in the form of sub-group by sex was considered appropriate as, towards the post-intervention period, the age of the children suggested that boys, in particular, may have been entering a period of growth.

One hundred and sixty two children were agreeable to having their height and weight measured. Five girls declined to be weighed but were not concerned about having their height measured. Children and their parents were made aware of the need for anthropometric measurements before agreeing to take part in the study. However, although every attempt was made to reassure children that all measurements would be kept confidential the decision of those who declined to be weighed was respected.

All measurements were taken either in the homes of the children or at school for those subjects who could not be contacted at home. Measurements at school were taken following the arrangement for a private room in the school, such as the office of the school nurse. Most children arrived in pairs or in groups to be weighed. Several interesting observations of the behaviour of children at the time of anthropometric measurements were apparent - whilst girls preferred to be measured individually, (instructing fellow subjects to wait outside the room), boys were not concerned about peers being present. In addition, boys were more likely to be self-conscious about their height measurements and girls acutely sensitive about their weight measurements. It is suggested that this is perhaps the predominant factor in a few girls declining to be weighed - they felt self-conscious about their body weight. Without having obtained a measurement of weight for those subjects who declined, it was then not possible to calculate BMR, BMI and PAL. One method of avoiding this complication may to ask reluctant subjects to weigh themselves (using the same equipment) and to record their measurement on a piece of paper and given to the researcher. It must be borne in mind however, that this method would not be without error (either intentional or unintentional).

For this study, a wall-fixed tape was used as digital scales and electronic stadiometer were not available for use at the time of measurement. Therefore, measurements were taken to nearest 0.5 cm and it is possible that errors were introduced on the part of the researcher (operator error - repeatable but a singular source of error). Had electronic equipment been available, in particular a stadiometer using an infra-red signal, this in itself may have been a source of interest to subjects of this age and may have distracted their attention (in a positive sense) away from the measurements themselves. Measurements, at least in duplicate or possible triplicate, may be used to calculate coefficient of variance to calculate the extent of human error in the recording of height and weight using simple methods. However, since the anthropometric measurements were viewed as a necessary evil by the subjects it may have been difficult to repeat measurements in this way and would have required additional time with subjects.

The mean height of the children in both the intervention and control groups, at baseline and post-intervention, concurred with that of children aged 11-14-years in the NDNS (Gregory *et al*, 2000). The mean height of boys aged 11-14-years in the NDNS was 155 cm and the same figure given girls aged 11-14-years. The mean weight of boys and girls in this study was greater than that reported for children of a similar age in the NDNS - where mean weight was reported to be 47 kg for boys and 49 kg for girls. The NDNS report girls to be slightly heavier than boys of the same age and these findings also concur with the data presented in Table 5.5 where girls in both groups are shown to be heavier than boys in both groups. The NDNS reported that 44% of girls aged 12 had entered menarche and this figure rose to 62% at age 13. This may account for the slightly heavier weight of girls in both the NDNS sample and this study sample - since attainment of a particular body weight is one of the triggers of menarche in girls.

Notably, the mean weight of children participating in this study is higher than the mean for children of a similar age in the NDNS. Two possible explanations are that; the study sample size is much smaller and that the NDNS does not provide reference data as such for children of this age from deprived social backgrounds. The NDNS does report anthropometric measurements by social class of head of household and also by income which does provide some useful reference data and it is here when certain favourable comparisons may be made. By head of household classification, there were no discernible differences between the heights and weights of boys or girls in the NDNS sample. However, when the data were presented by classification of gross weekly household income, the data show that both boys and girls from families where the gross weekly household income is less than £160.00, and between £160.00 to less than £280.00 per week, are both shorter and lighter than children from families whose gross weekly income is greater than £280.00. To further highlight this point, children living in families with a gross weekly income of £600.00 or more are shown to be 9-10 cm taller and 8-9kg heavier.

The data presented in Figure 5-3 and Figure 5-4 show that Townsend score correlates negatively to height in children participating in this study. The relationship is small but nevertheless significant and persists from phase T0 to phase T1 and persists despite significant growth in both the intervention and control group. This data may suggest that children from socially deprived backgrounds in the region of Tyne and Wear may be shorter, but not necessarily lighter, depending upon the severity of social deprivation. Further analysis of anthropometric data collated in this study, at a later date, could involve investigating the relationship between height and social deprivation in both boys and girls since previous studies have shown that boys in particular, from low-income families, are more likely to be shorter and lighter than their peers from higher income groups.

The BMI of the children taking part in this study is comparable to data published in the 2000 NDNS (Gregory *et al*, 2000). The mean BMI for girls in the intervention and control group at baseline were 22.1 and 21.0 respectively. At post-intervention the figures increased slightly but significantly to 23.8 and 22.1. All these values are slightly higher than those reported in the NDNS - whereby girls aged 12 years had a mean BMI of 20 and girls of 13, a mean BMI of 21. The mean BMI of boys in at baseline was 21.3 (intervention group) and 20.2 (control group). At post-intervention the mean BMI of boys in the intervention group was 23.1 and in the control group 21.5. All these values are higher than those reported in the NDNS for boys of a similar age; the mean BMI of boys aged 11-, 12- and 13-years-old was 19. The increase in BMI is likely to be concomitant with the significant increase in height and weight demonstrated by both sexes in both groups. A BMI value greater than 25 is accepted to indicate that an individual is overweight and a BMI value greater than 30 indicates obesity. Thus, the percentage of children with a BMI value greater than 25 indicates this sub-group may have increased their body fatness disproportionate and concordant with an increase in body weight. This increase in body weight may possibly be attributed to a storing of energy as a requirement in excess of that required for growth. Therefore, it would appear wise to approach the interpretation of BMI and body fatness with extreme caution in the case of older children and adolescents and it may be possible that further allowances need to be made in terms of estimating energy requirements for individuals of this age group. The numbers of children whose BMI was greater than 30 is a cause for concern in children of this age. It may be appropriate to perform follow-up anthropometric measurements on the children participating in this study to monitor height, weight and BMI and to identify the prevalence of overweight and obese children living in socially deprived areas of the North East of England.

Figure 6-1 Comment from girl (control group) after completing first food diary

Food diary: Any Comments?

Have you any comments about what you have eaten during the 3 days?

no but I enjoyed doing the food diary and I hope I can do it again

Do you think you have eaten as you would usually do?

Yes I think I have ~~eaten~~ because I write the food and drink I had

Figure 6-2 Comment from boy (control group) on completing third food diary

Do you think you have eaten as you would usually do?

No, because on the Saturday I:
a) went to my Aunt Mary's who enjoy's feeding us silly
b) went to a wedding reception with a buffet

6.1 Introduction

6.1.1 Overview of methods for the assessment of dietary intake by children aged 11-14-years old

The method of choice for dietary assessment should be applicable to the population group under study, to the time period of assessment, to the nutrients and foods under assessment and to the resources available. Bone (1992) suggests that where dietary intake within a specified time period is to be assessed, both retrospective and prospective methods may be suitable. Examples of such methods are twenty-four hour recall, and prospective methods such as weighed dietary inventory, estimated food diary and experimenter observation. In dietary studies where general eating behaviour and habitual consumption of foods are to be investigated, Kemm & Booth, (1992) suggest that suitable retrospective (or recall) methods are diet history and 24-hour recall.

Weighed dietary records are recognised to be a suitable method of obtaining detailed dietary information in children of all ages (particularly in the clinical setting where comprehensive facilities and trained staff are available to provide assistance), but accuracy largely depends upon adult supervision and detailed instruction (Mascarenhas *et al*, 1998). Two main methods used in the quantification of food and nutrient intakes in free-living subjects, are the direct weighing of foods or self-estimate of foods consumed (Hackett *et al*, 1983, Adamson *et al*, 1992a, Robson & Livingstone, 2000).

Diet history methods have been employed in dietary studies of children (Livingstone *et al*, 1992) and are considered to be an adequate if not preferable method of measuring long-term habitual dietary intake (Black *et al*, 2000). The National Diet and Nutrition Survey of children aged 4 to 18 years (Gregory *et al*, 2000) employed 7-day weighed diet diaries and each subject was issued with a set of digital weighing scales. Two recording diaries were also given to subjects - a 'Home Record' diary and an 'Eating and Drinking Away From Home'. For a dietary survey of this size, some considerable financial cost would be invested in the tools used for data collection and analysis that may not be feasible for smaller dietary surveys.

A dietary diary followed by interview to clarify diary entries may be particularly suitable for use in older children capable of recording much of their intake (Hackett *et al*, 1983, 1986, Adamson *et al*, 1992a, 1992b). Livingstone & Robson (2000) suggest that self-report of dietary intake in children be reserved for subjects aged 8 years or older, since before this age, children may lack the cognitive abilities (i.e. conceptualisation of food portion size, memory and attention span) required to carry out this task.

The use of food photographs in the clarification and quantification of food portion sizes during subject interviews are recognised to minimise portion size errors (Robson & Livingstone, 2000, Welten *et al*, 2000). However, even with food photographs, small portions have been commonly overestimated, and larger portions underestimated (Lucas *et al*, 1995) by adult participants. There is little data at present that provides evidence of over- and under-estimation of food portion sizes by children and adolescents using methods that make use of food photographs or food atlas. There is a pressing need for research to be undertaken in this area and a need for a child-friendly food photographic atlas to be developed for use in dietary surveys of young people.

Self-reporting of diet in the survey of young people's diets is a feasible method for small studies since the cost in terms of consumables and researcher effort is much lower than for weighed dietary records. A great deal of detail may also be included in a written dietary record - detail that may not be possible in other methods, such as diet history. Dietary diaries of a shorter recording period may possibly avoid fatigue on the part of the person carrying out the recording and a shorter recording period will facilitate the procedure of personal interview following completion of the diary - since there is less for a young person to remember.

Written information may also act as a memory prompt as other data such as place of purchase, origin and time of consumption are all recorded by subjects. When a shorter but repeatable recording period does not negatively impact upon the reliability , validity and accuracy of the data thus obtained (Adamson 1993, PhD thesis), again it may be particularly suitable for use by older children and adolescents without the need for continual adult supervision.

6.1.2 Aims

The specific aims were to:

- **Determine mean intakes of energy, protein, starch, sugar, total fat and saturated fat and non-starch polysaccharide in the diets of the children at baseline and at post-intervention**
- **Determine changes in mean intakes of energy, protein, starch, sugar, total fat and saturated fat and non-starch polysaccharide in the diets of the children following the intervention**
- **Determine intake of foods at baseline and post-intervention by the five groups of the National Food Guide**
- **Determine intake of Vitamin C, ß-carotene, iron and calcium in the diets of the children**
- **Compare differences in changes in intake of foods and nutrients between children attending the intervention and children in the control group**

6.2 Method

6.2.1 Collection of dietary data

The intake of foods and beverages by the children were recorded by self-report of dietary intake using a dietary diary and interview method (Hackett *et al*, 1983, Adamson *et al*, 1992[a]). A 3-day estimated dietary diary further adapted from that used by Adamson *et al* (1992[a]) (Figure 6-3, Figure 6-4, Figure 6-5, Figure 6-6) was used by the subjects to record dietary intake in household measures.

Figure 6-3 Food diary designed for use by children participating in The Good Food Study (front page)

HUMAN NUTRITION RESEARCH CENTRE

UNIVERSITY OF NEWCASTLE

The Good Food Study

FOOD DIARY

Name...

Please start this food dairy on...

Keep this booklet with you to record everything you eat and drink. Write as much information as you can. We will sort out any problems you may have together.

If you have any questions about the diary, please contact:
Sam Revill Tel: 0191 222 8719

ID_____/________ Food diary no________

Figure 6-4 Food diary (Pages 1 & 2)

Please read the following instructions and try to follow them as carefully as possible.

To help, we have included an example of a completed day (on the following page).

1. Please write down *everything* that you eat, no matter how small the amount, during the 3 days. Do not include any leftovers.

2. Use a new line for *each* food item.

3. Give as much information as possible about the food and drink that you have. Include:
   - Brand name and the flavour
   - Packet weight, for tinned or bottled foods and drinks
   - How you cooked the food e.g. fried, grilled, oven, raw etc.
   - Estimate the portion size you have had e.g. $\frac{1}{2}$ a tin, a packet

4. If you eat ready-made foods, please cut out and save any nutritional information so that we can accurately measure what you have eaten. These will be collected with the finished diary.

5. If you are eating out, describe what was in the meal and guess how much of each food you ate.

6. Please tell us where you got the food or drink from e.g. school, home, shops.

Remember:

Eat and drink as you would do normally. All the information we collect about what you eat is confidential and there are no right or wrong answers.

Please fill in the food diary:

From………………………………. To……………………………….

Sam will visit you to check through your food diary with you.

Please bring this dairy to school with you on

……………………………………………………………………

- **Do you take any vitamin / mineral tablets**
  (please put a circle around the right answer)

  Yes **No**

  (If yes please describe)

……………………………………………………………………

……………………………………………………………………

Figure 6-5 Food diary (Pages 3 & 4 – Example pages)

Example

Day.................................... Start each day on a new sheet

Time of Day	Food & Drink Include: Brand name, flavour and packet weight	Cooking method e.g. fried, grilled	Amount eaten e.g. cup, slice, teaspoon, bowl, portion of family meal	Bought from home, shop school	Sam's section: Food photo	Sam's section: Weight	Sam's section: Food code
08.15am	Fresh orange juice (carton)		250ml carton	Home			
"	Cheerios		Large bowl	Home			
"	Semi-skimmed milk (carton)		¼ pint	Home			
10.30am	Pepsi		330ml can	Shop			
12.20pm	Ham sandwiches		2 slices (white)	Home			
"	Crisps (salt & vinegar)		28g	School			
"	Banana		medium	School			
"	Mars bar (snack size)		42g	School			
"	Strawberry milk shake (carton)		500ml	Shop			
5.30pm	Mc Can chunky oven chips	Oven	4	Home			
"	Birds Eye economy fish fingers	Grilled	Large portion	Home			
"	Safeways frozen garden peas	Boiled	2 tablespoons	Home			
"	Salt		sprinkle	Home			
"	Tomato ketchup		Dessertspoon	Home			
"	Ski Low fat peach yoghurt		150g pot	Home			
10.00pm	Cadburys choco options (made with water)		1 Packet (11g)	Home			

Figure 6-6 Food diary (Pages 5 to 22)

Day..................................

Start each day on a new sheet

Time of Day	Food & Drink Include: Brand name, flavour and packet weight	Cooking method e.g. fried, grille	Amount Eaten e.g. cup, slice, teaspoon, bowl, portion of family meal	Bought from home, shop school	Sam's section Food photo	Weight	Food code

Each food diary was completed during two weekdays and one weekend day to account for differences in consumption patterns between school and home. Subjects were asked to complete two food diaries at baseline, and two following the intervention period. An interval of between two and four weeks was employed between recording periods. All dietary interviews took place in school during the school summer term.

Each subject attended an initial interview to receive a diary and instructions on how to complete it. Subjects were asked to record all foods and beverages consumed on each of the three days, using household measures, including any snacks and confectionery but excluding left-overs. Subjects were also asked to record the time of consumption, the method of cooking (if applicable), and the origin of the food (i.e. family home, school, self-purchase at shops etc.) and their bedtime (relevant to dental health, see Chapter 7).

Subjects were interviewed on completion of the diary to clarify and enlarge upon the items recorded in the diary. The portion sizes of recorded foods were identified with the use of a photographic food atlas (Nelson *et al*, 1997). Subjects were asked to select the photograph representing the portion size of the food or drink consumed and the selection noted. Photographs in the food atlas depicting the two largest portion sizes of each type of food were covered in order to minimise the potential for over-estimation of portion size in order to assist children in conceptualising the size of the portion they had consumed.

The diaries of subjects not interviewed within two days of diary completion (due to absence from school) were excluded and a further diary issued. No limit was set on the number of re-issues.

Figure 6-7 Classroom release slips for children attending interview at school to clarify recording of dietary intake

The Good Food Study

Sam Revill (Nutritionist)
Human Nutrition Research Centre
University of Newcastle
Tel: 0191 222 8719

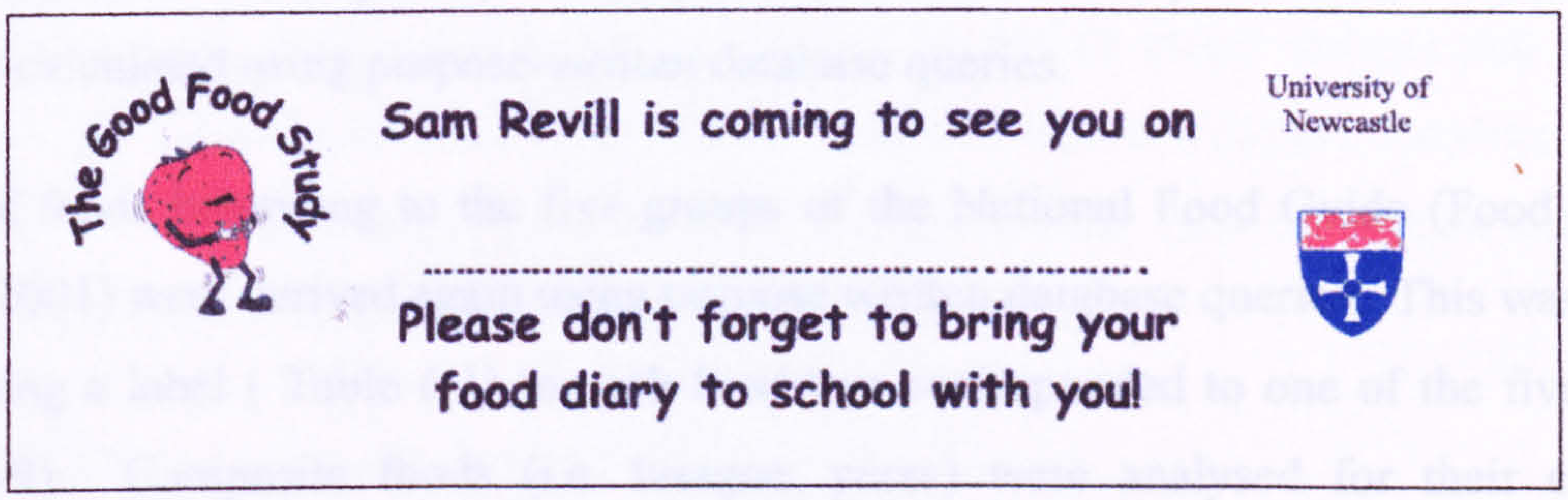
.... is taking part in 'The Good Food Study' organised by the University of Newcastle.

Please may this child, with your permission, be allowed to leave the classroom for twenty minutes on.......................... at ....to go to...............................

Thank you very much.

Classroom release slips (Figure 6-7)and a reminder slip (Figure 6-8) for children were designed and photocopied and delivered to children using form registers to minimise the number of children forgetting to bring their completed food diary to school and obtain permission from teaching staff for children to leave their classroom to attend an interview.

Figure 6-8 Slip given to children at school as a reminder to bring their completed food diary to school on the day of interview



6.2.2 Data processing

Descriptive and quantitative dietary data were entered and stored on a computer relational database (Access Database, Microsoft Corporation Inc., C.A. USA) purposely designed and constructed for the study.

Initial processing of the dietary data involved allocating an appropriate food code and weight to each individual diary entry. For any one food or beverage item recorded by a child in the food diary, nine entries were made to the database, these were; the phase (baseline or post-intervention), the date, the diary day number (1 – 6, where 1=Thursday, 2= Friday, 3=Saturday, 4= Sunday, 5=Monday and 6= Tuesday), the time of consumption, the origin of the item, the method of cooking (if applicable), a description of the item, the weight of the item and the appropriate food code.

All food and beverages were coded using an electronic format of McCance and Widdowson's 'The Composition of Foods' 5th edition (Paul & Southgate, 1978) and all supplements. The relational fields of the study database were designed to draw food composition by default from the computerised food tables providing information on the nutritional composition of over 2000 food and beverage items. Average portion sizes for remaining foods and beverages were obtained from reference literature (Crawley, 1990). The weight/volumes of commercially produced goods were obtained from product labels and/or from the company literature of major food manufacturers.

6.2.3 Data analysis

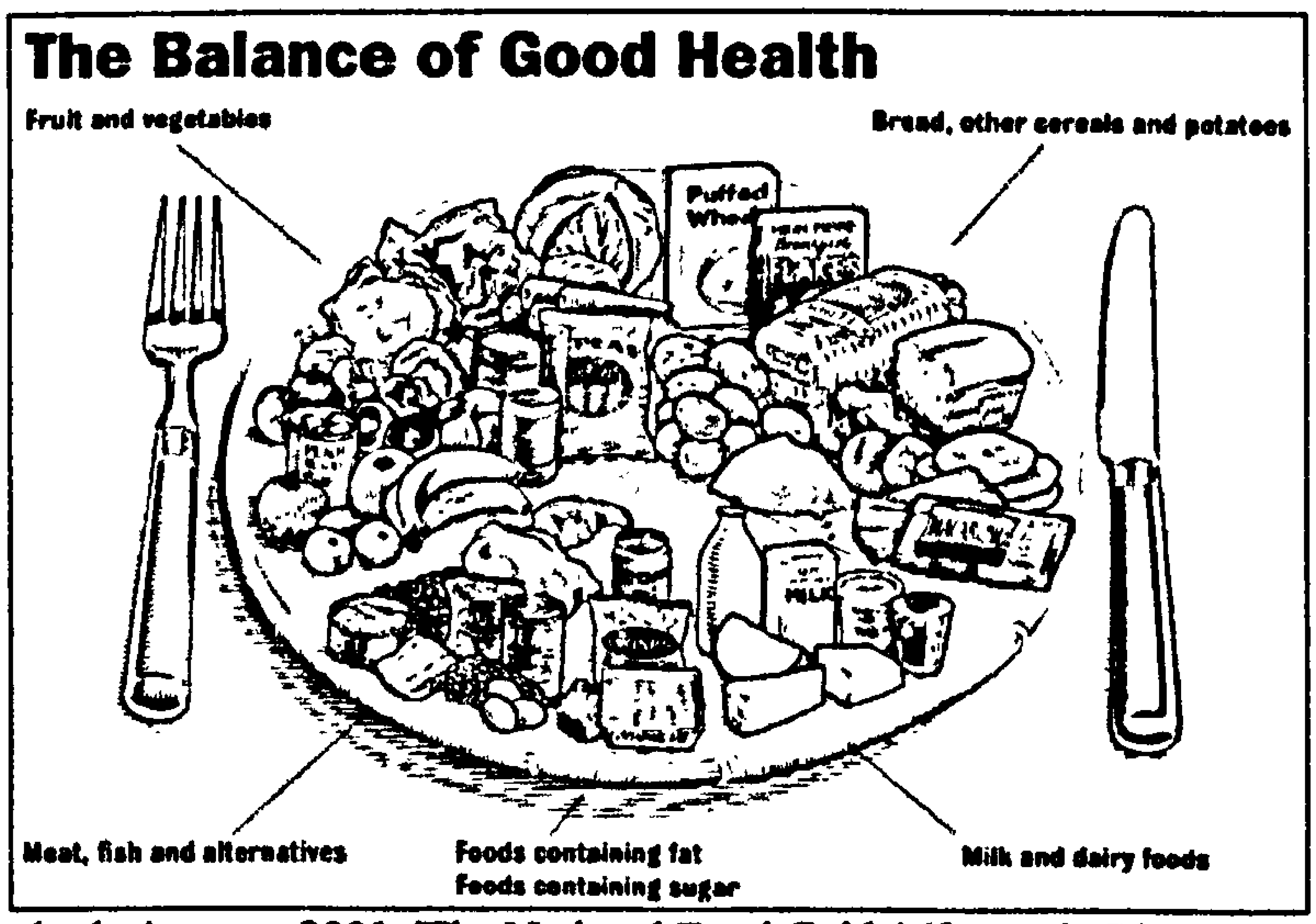
Intakes of macronutrients and micronutrients were determined using purpose-written database queries to calculate daily total (g) and resulting mean daily intakes (g/day) for each individual. Database queries were devised to calculate the percentage of food energy provided by dietary fats, total carbohydrate, starch and protein. (For total sugar and non-milk extrinsic sugars intake please refer to Chapter 7). Dietary intake of vitamin C, β-carotene, iron and calcium were also calculated using purpose-written database queries.

Intakes of foods belonging to the five groups of the National Food Guide (Food Standards Agency, 2001) were derived again using purpose written database queries. This was achieved by attaching a label (Table 6.1) to each food that corresponded to one of the five groups (Figure 6-9). Composite foods (i.e. lasagne, pizza) were analysed for their content by percentage contribution to the five groups (g/100g) and an appropriate weighting factor applied.

Table 6.1 Labelling of foods and beverages within computerised food tables to assign National Food Guide Groups

Label	National Food Guide Groups
1	Milk and dairy foods
2	Fruit and vegetables
3	Meat, fish and alternatives
4	Bread, other cereals and potatoes
5	Foods containing fat and sugar

Figure 6-9 The National Food Guide



Source: Food Standards Agency, 2001 'The National Food Guide' (formerly The Balance of Good Health Model)

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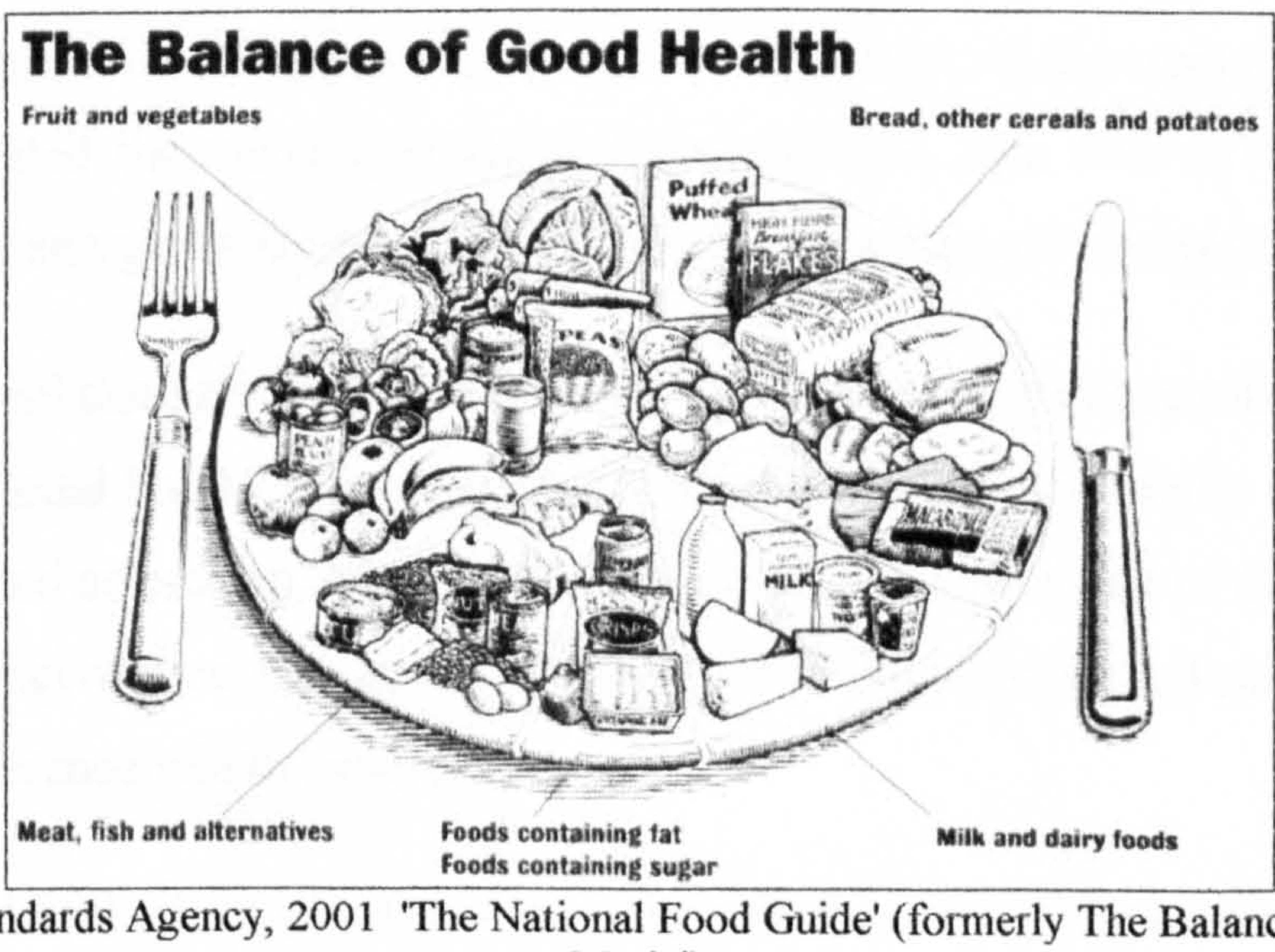


Source: Food Standards Agency, 2001 'The National Food Guide' (formerly The Balance of Good Health Model)

The data were subsequently transferred to SPSS for analysis. Primary analyses were carried out on an intention to treat basis and included all subjects irrespective of attendance to the Food Club. The primary analyses took the form of determining the mean (SE) of intakes of macro- and micronutrients of both groups using SPSS. Differences between intervention and control group at baseline and following intervention were determined using t-test. Within group changes following intervention were determined using paired t-test. Secondary analyses by sex were carried out using paired t-test for within group changes and differences between groups determined using t-test. The relationship between dietary variables and social deprivation were investigated using Pearson's' and Spearmans' rank correlation and by linear regression analysis (as appropriate to the normality of the data).

6.3 Results

One hundred and sixty seven children (84 children in the intervention group and 83 children in the control group) completed all four dietary diaries at phase T0 and T1. Of the 171 children completing the two sets of dietary diaries phase T0 and T1, two subjects were excluded from the final analysis as having withdrawn from the Food Club during the Spring Term and two subjects excluded on the basis of not completing questionnaires (see Chapter 8). One further subject was excluded from the final analysis due to incomplete dietary diaries. (Examples of diary entries are given Section 12.11).

Primary statistical analysis of the macronutrient intake of children at baseline showed that the data were normally distributed and median values for energy (MJ), total carbohydrate (g), protein (g), total fat (g) and saturated fat (g) to be within 2%, 4%, 4%, 3% and 6% of the mean values respectively. Primary analysis of the intake of the same nutrients at post-intervention revealed the median values to be within 1%, 2%, 5%, <1% and <1% of the median values for energy, total carbohydrate, protein, total fat and saturated fat respectively.

A primary statistical analysis of the foods consumed by the children according to the five food groups of the National Food Guide showed that the data were not normally distributed and the have been presented as median values (IQ range). Mann Whitney test of differences between the control and intervention group was employed and Wilcoxon signed rank test to examine the statistical difference within groups.

Primary statistical analysis of micronutrient intake by children of the intervention and control group showed the data not be normally distributed and median values to be between 9% and

17% removed from the mean. Statistical methods were adjusted appropriately for micronutrient intakes, which are reported as median values and interquartile ranges as observed.

6.3.1 Energy and macronutrient intake

The mean energy intake of the children in the intervention and control group are presented below in Table 6.2 . Intake of macronutrients and percentage contribution of macronutrients to daily energy intake are also presented in Table 6.2 .

There were no significant differences in mean energy intake between the two groups and no significant differences between the mean percentage contribution of macronutrients to the total energy intake of children in the intervention and control group at baseline.

Table 6.2 Mean (SD) of daily intake of energy and macronutrient and percentage contribution of macronutrients to total daily energy intake of children in the intervention group and the control group at baseline (T0)

Macronutrient	Mean (SD) of intake/contribution(%) Intervention $n = 84$	Control $n = 83$	P value*
Energy (MJ)	8.6 (2.0)	8.6 (2.1)	0.953
Protein (g)	62.0 (17.0)	61.6 (18.0)	0.914
Total Fat (g)	84.4 (24.2)	82.3 (21.1)	0.546
Saturated Fat (g)	28.6 (9.5)	27.5 (8.8)	0.467
Total Carbohydrate (g)	272.5 (60.3)	272.5 (70.9)	0.615
Starch (g)	151.3 (36.7)	148.1 (33.7)	0.594
Non-starch polysaccharide (g)	10.7 (2.9)	10.6 (3.0)	0.811
% EI from Protein	12.3 (2.1)	12.3 (2.3)	0.992
% EI from Total Fat	36.3 (3.8)	35.3 (4.2)	0.248
% EI from Saturated Fat	12.1 (1.9)	11.8 (2.3)	0.383
% EI from Total Carbohydrate	50.9 (4.0)	51.8 (4.3)	0.187
% EI from Starch	28.3 (3.5)	28.0 (4.1)	0.660

* t-test of differences between control and intervention group

Data presented in Table 6.3 show the mean energy intake and of children at post-intervention and the contribution of macronutrients to mean daily energy intake.

Table 6.3 Mean (SD) of daily intake of energy and macronutrient and percentage contribution of macronutrients to total daily energy intake of children in the intervention group and the control group at post-intervention (T1)

Nutrient	Mean (SD) of intake		
	Intervention $n = 84$	Control $n = 83$	P value*
Energy (MJ)	9.1 (2.4)	9.4 (2.2)	0.466
Protein (g)	69.2 (20.3)	71.3 (20.1)	0.521
Total Fat (g)	90.0 (27.5)	91.4 (27.3)	0.736
Saturated Fat (g)	31.0 (10.5)	30.3 (10.0)	0.664
Total Carbohydrate (g)	287.3 (73.7)	296.8 (67.5)	0.258
Starch (g)	167.0 (45.0)	171.2 (41.2)	0.476
Non-starch polysaccharide (g)	12.1 (4.0)	12.8 (3.7)	0.274
% EI from Protein	13.1 (2.0)	13.0 (2.0)	0.774
% EI from Total Fat	36.3 (3.7)	35.9 (3.7)	0.391
% EI from Saturated Fat	12.5 (2.0)	11.9 (2.0)	0.057
% EI from Total Carbohydrate	50.1 (4.1)	50.8 (4.0)	0.242
% EI from Starch	29.6 (3.5)	29.9 (3.7)	0.995

* t-test of differences between control and intervention group

Post-intervention macronutrient intake by children was not found to be statistically different between groups. A non-significant tendency towards higher mean percentage contribution of saturated fat was observed in children in the intervention group. The data presented in Table 6.4 show mean (SE) of changes in daily intake of energy and macronutrients between baseline and post-intervention recording periods.

Table 6.4 Mean (SE) of the change in daily intake of energy and macronutrients and percentage contribution of macronutrients to total daily energy intake of children in the intervention group and the control group between baseline and post-intervention (T1-T0)

Nutrient	Mean (SE) of change in daily intake (T1 –T0)					
	Intervention $n = 84$	P value**	Control $n = 83$	P value**	C v I[Ψ]	P value*
Energy (MJ)	+0.5 (0.3)	0.000	+0.8 (0.3)	0.003	0.3	0.422
Protein (g)	+7.2 (2.4)	0.002	+10.0 (2.1)	0.000	2.5	0.464
Total Fat (g)	+6.0 (3.4)	0.000	+9.49 (3.0)	0.000	3.9	0.398
Saturated Fat (g)	+2.5 (1.2)	0.000	+3.0 (1.2)	0.024	0.4	0.839
Total Carbohydrate (g)	+14.0 (5.2)	0.000	+18.0 (7.8)	0.030	8.0	0.498
Starch (g)	+15.0 (5.0)	0.000	+23.2 (4.3)	0.000	8	0.210
Non-starch polysaccharide (g)	+1.5 (0.5)	0.001	+2.2 (0.4)	0.000	0.8	0.201
% EI from Protein	+0.7 (0.5)	0.005	+0.7 (0.3)	0.018	0	0.887
% EI from Total Fat	+0.2 (0.4)	0.439	+0.5 (0.4)	0.244	0.2	0.737
% EI from Saturated Fat	+0.4 (0.3)	0.240	+0.1 (0.3)	0.918	0.3	0.460
% EI from Total Carbohydrate	-0.8 (0.5)	0.130	-0.9 (0.5)	0.122	0.1	0.885
% EI from Starch	+1.3 (0.5)	0.006	+1.6 (0.5)	0.002	0.2	0.704

* t-test of differences in changes between control and intervention group

** t-test of differences within groups (T1-T0)

Ψ mean difference of the differences in changes in control and intervention group (control value minus intervention value of change)

The data show an increase in mean energy intake (MJ) in the intervention group and in the control group, as may be expected in children of this age. This increase was significant within each group but there were no significant differences in increase in mean energy intake between the two groups. Both groups showed a significant increase in mean intake of protein, total fat and saturated fat, total carbohydrate, starch and non-starch polysaccharide but no significant differences in change in intake of these nutrients was observed between the two groups. Between phase T0 and T1 there was a significant increase the amount of energy derived from starch in the children's diets - this was significant within both groups. The percentage of energy provided by total fat, saturated fat, and starch increased slightly but not significantly in both groups (not more than 1% in either group).

6.3.1.1 Energy and macronutrient intake by sex

The mean (SD) of daily intake of energy (MJ/day) and intake of macronutrients (g/day) of the boys and girls in the intervention and control group at baseline are displayed in Table 6.5.

Table 6.5 Mean (SD) of daily intake of energy (MJ/day) and macronutrients (g/day) of boys and girls in the intervention group and the control group at baseline (T0)

Nutrient		Mean (SD) of intake		
		Intervention Boys n=31 Girls n=53	**Control** Boys n=31 Girls n=52	**P value***
Energy (MJ)	Boys	9.9 (2.3)	9.9 (1.7)	0.993
	Girls	7.8 (1.3)	7.9 (1.9)	0.789
Protein (g)	Boys	71.3 (18.5)	72.7 (15.7)	0.757
	Girls	56.4 (13.3)	55.1 (16.0)	0.544
Total Fat (g)	Boys	99.5 (26.8)	96.8 (21.1)	0.667
	Girls	75.6 (17.5)	73.6 (19.6)	0.519
Saturated Fat (g)	Boys	34.2 (10.8)	32.5 (8.3)	0.484
	Girls	24.8 (7.9)	25.3 (6.7)	0.576
Total Carbohydrate (g)	Boys	307.3 (67.6)	315.6 (64.2)	0.621
	Girls	252.1 (45.1)	254.2 (65.9)	0.924
Starch (g)	Boys	172.3 (40.5)	166.7 (32.5)	0.551
	Girls	139.1 (28.0)	136.4 (30.0)	0.630
Non-starch polysaccharide (g)	Boys	12.1 (3.3)	11.5 (2.7)	0.470
	Girls	9.9 (2.1)	10.1 (3.0)	0.770

* t-test of differences between the intervention and control group by sex

Mean values are very similar for both sexes and no significant differences were found between daily intake of energy and intake of macronutrients between boys and between girls of both groups. Table 6.6 presents the results of the analysis of daily intake of energy and macronutrients of the intervention and control group by sex at phase T1. As at baseline, no significant differences were observed between the macronutrient intake between boys and between girls of both groups, with the exception of non-starch polysaccharide. A non-significant tendency towards a slightly higher mean intake of non-starch polysaccharide was observed in girls of the control group.

Table 6.6 Mean (SD) of daily intake of energy and macronutrients of boys and girls in the intervention group and the control group at post-intervention (T1)

Nutrient		Mean (SD) of intake		
		Intervention Boys *n*=31 Girls *n*=53	**Control** Boys *n*=31 Girls *n*=52	**P value***
Energy (MJ)	Boys	10.6 (1.8)	10.8 (1.9)	0.614
	Girls	8.2 (2.2)	8.5 (1.9)	0.494
Protein (g)	Boys	82.5 (18.5)	84.6 (19.1)	0.659
	Girls	61.5 (17.1)	63.4 (16.4)	0.545
Total Fat (g)	Boys	105.5 (21.4)	107.2 (25.9)	0.785
	Girls	81.0 (26.6)	82.4 (23.4)	0.761
Saturated Fat (g)	Boys	29.7 (10.1)	30.3 (8.1)	0.571
	Girls	32.4 (10.8)	29.7 (10.6)	0.195
Total Carbohydrate (g)	Boys	324.9 (59.3)	336.8 (59.1)	0.432
	Girls	257.5 (70.3)	270.3 (58.9)	0.313
Starch (g)	Boys	193.6 (19.1)	194.4 (37.6)	0.908
	Girls	150.6 (41.2)	157.6 (41.3)	0.365
Non-starch polysaccharide (g)	Boys	14.6 (3.8)	14.6 (3.9)	0.851
	Girls	10.6 (3.5)	11.8 (3.1)	0.071

* t-test of differences between the intervention and control group by sex

The data presented in Table 6.7 show the mean (SE) of change in daily intake of energy and of change in intake of macronutrients by boys and by girls of the intervention and control group between baseline and post-intervention. A small but significant increase in mean daily intake of energy was observed in boys and girls of the control group, as may be expected in children of this age. The change in daily intake of energy of girls in the intervention group only was not found to be significant. The mean intake of protein increased significantly for boys and girls in both groups. In the control group girls only, a significant increase in mean intake of total fat of 9.1g/day was observed whilst in boys a non-significant tendency towards an increase in total fat observed (P=0.087). Boys and girls in both groups increased their intake of total carbohydrate with a non-significant tendency towards increased intake in control group boys only.

Table 6.7 Mean (SE) of the change in daily intake of energy and macronutrients of boys and girls in the intervention group and the control group between baseline (T0) and post-intervention (T1)

Nutrient		Mean (SE) of change in daily intake (T1 – T0)					
		Intervention Boys n=31 Girls n=53	P value**	Control Boys n=31 Girls n=52	P value**	C v I$^{\Psi}$	P value*
Energy (MJ)	Boys	+0.6 (0.3)	0.076	+0.8 (0.4)	0.044	0.3	0.648
	Girls	+0.3 (0.3)	0.296	+0.7 (0.3)	0.021	0.1	0.425
Protein (g)	Boys	+11.2 (3.5)	0.003	+12.0 (3.5)	0.002	2.6	0.879
	Girls	+5.0 (3.1)	0.114	+8.8 (2.6)	0.001	0.4	0.359
Total Fat (g)	Boys	+6.1 (4.3)	0.172	+10.4 (5.9)	0.087	4.0	0.556
	Girls	+5.3 (4.2)	0.212	+9.1 (3.4)	0.009	1.0	0.476
Saturated Fat (g)	Boys	+2.7 (1.9)	0.768	+3.3 (2.4)	0.315	0.5	0.854
	Girls	+2.2 (1.5)	0.000	+2.6 (1.3)	0.001	0.8	0.867
Total Carb (g)	Boys	+17.6 (10.8)	0.114	+21.2 (11.6)	0.077	8.0	0.820
	Girls	+5.4 (9.9)	0.589	+17.1 (10.5)	0.108	6.8	0.417
Starch (g)	Boys	+21.3 (7.3)	0.007	+28.0 (6.2)	0.000	0.6	0.486
	Girls	+11.5 (6.1)	0.065	+21.2 (5.8)	0.001	5.4	0.257
NSP (g)	Boys	+2.6 (0.7)	0.004	+3.0 (0.6)	0.000	0.9	0.962
	Girls	+0.7 (0.5)	0.207	+1.8 (0.5)	0.001	0.2	0.163

* t-test of differences in changes in the intervention and control group by sex
** t-test of differences in changes within boys and within girls
$^{\Psi}$ mean difference of the differences in changes in control and intervention group (control value minus intervention value of change)

All children participating in the study increased their mean intake of starch and non-starch polysaccharide. In boys and girls of the control group and boys in the intervention group the mean increase in intake of starch (g/day) and in intake of non-starch polysaccharide was observed to be significant with a non-significant tendency observed in girls of the intervention group. Data displayed in Table 6.7 show change in daily intake of energy and change in macronutrient intake within genders and group, several changes were found to be significant. No significant differences were observed between the boys and girls of the two groups.

The percentage contribution of macronutrients to the total daily energy intake of boys and of girls at baseline are shown below in Table 6.8 and at post-intervention in Table 6.9.

Table 6.8 Mean (SD) of percentage contribution of macronutrients to total daily energy intake of boys and girls in the intervention group and the control group at baseline (T0)

Contribution of nutrient to total daily energy intake (%)		Mean (SD) of % contribution Intervention Boys n=31 Girls n=53	Control Boys n=31 Girls n=52	P value*
Protein	Boys	12.3 (2.8)	12.6 (2.2)	0.571
	Girls	12.3 (2.3)	12.0 (4.3)	0.589
Total Fat	Boys	36.8 (3.3)	36.1 (4.8)	0.433
	Girls	35.6 (4.0)	35.0 (4.1)	0.481
Saturated Fat	Boys	12.6 (2.0)	12.1 (2.2)	0.389
	Girls	11.9 (1.8)	11.7 (2.3)	0.684
Total Carbohydrate	Boys	50.0 (4.0)	50.8 (4.3)	0.350
	Girls	51.5 (3.9)	52.2 (4.3)	0.396
Starch	Boys	28.0 (3.2)	27.0 (3.2)	0.216
	Girls	28.5 (3.7)	28.7 (4.5)	0.757

* t-test of differences between the intervention and control group by sex

Table 6.9 Mean (SD) of percentage contribution of macronutrients to total daily energy intake of boys and girls in the intervention group and the control group at post-intervention (T1)

Contribution of nutrient to total daily energy intake (%)		Mean (SD) of % contribution Intervention Boys n=31 Girls n=53	Control Boys n=31 Girls n=52	P value*
Protein	Boys	13.3 (1.8)	13.3 (1.8)	0.970
	Girls	13.0 (2.1)	12.8 (2.1)	0.700
Total Fat	Boys	36.9 (3.8)	36.4 (3.6)	0.640
	Girls	36.1 (3.6)	35.7 (3.8)	0.511
Saturated Fat	Boys	12.9 (2.0)	12.2 (1.8)	0.140
	Girls	12.2 (2.0)	11.7 (2.1)	0.172
Total Carbohydrate	Boys	49.3 (4.5)	50.1 (4.2)	0.498
	Girls	50.5 (4.9)	51.2 (3.9)	0.356
Starch	Boys	28.0 (3.2)	29.0 (3.9)	0.651
	Girls	29.5 (3.5)	29.9 (3.5)	0.750

* t-test of differences between the intervention and control group by sex

The data in Table 6.8 show similar values between the sexes for percentage energy derived from protein, total fat, saturated fat, total carbohydrate and starch. The results of the secondary analysis by sex closely reflect the group values for percentage contribution of macronutrients to the total daily energy intake. Between groups, no significant differences were found at baseline in the contribution of nutrients to the total daily energy intake of boys and girls. At post-intervention values for the percentage contribution of nutrients to total daily energy were again seen to be similar between boys and between girls of both the intervention and control groups.

A slight increase in the percentage of energy derived from protein between baseline and post-intervention can be observed in both sexes in the finding displayed in Table 6.10 . This increase was found to be significant in intervention group girls only and presented as a non-significant tendency in boys of both groups and girls in the control group. The changes in percentage energy derived from total fat, saturated fat and total carbohydrate were not seen to be significant in either sex in both groups. Boys were observed to show a small but significant increase in the contribution of starch to total energy in their diets whereas in girls a similar small increase appeared to be a non-significant tendency. Differences in changes between groups were not significant.

Table 6.10 Mean (SE) of the change in percentage contribution of macronutrients to total daily energy intake of boys and girls in the intervention group and the control group between baseline and post-intervention (T1-T0)

Change in contribution of nutrient to total daily energy intake (%)		Mean (SE) of change in contribution (%) Intervention Boys n=31 Girls n=53	P value**	Control Boys n=31 Girls n=52	P value**	C v I[Ψ]	P value*
Protein	Boys	+1.0 (0.3)	0.014	+0.7 (0.4)	0.072	0	0.627
	Girls	+0.6 (0.3)	0.086	+0.7 (0.4)	0.083	0.1	0.881
Total Fat	Boys	+0.03(0.7)	0.962	+0.3 (0.8)	0.647	0.2	0.754
	Girls	+0.5 (0.6)	0.361	+0.6 (0.6)	0.318	0.1	0.924
Saturated Fat	Boys	+0.3 (0.5)	0.557	+0.04 (0.4)	0.919	0.3	0.711
	Girls	-0.3 (0.5)	0.306	-0.01 (0.4)	0.971	0.5	0.477
Total Carb	Boys	-0.5 (0.9)	0.568	-0.7 (0.8)	0.361	0.1	0.826
	Girls	-1.0 (0.6)	0.150	-1.0 (0.6)	0.146	0.4	0.969
Starch	Boys	+1.5 (0.5)	0.014	+2.1 (0.6)	0.006	0.2	0.505
	Girls	+1.2 (0.6)	0.074	+1.1 (0.6)	0.089	0.4	0.975

* t-test of differences in changes between the intervention and control group by sex

** t-test of differences within boys and within girls

Ψ mean difference of the differences in changes in control and intervention group (control value minus intervention value of change)

6.3.2 Intake of foods by National Food Guide grouping

The product of assigning the children's food intake to the five groups of the National Food Guide are displayed in Table 6.11 and Table 6.12 for baseline and post-intervention respectively.

Table 6.11 Median (IQ range) of daily intake of food groups by National Food Guide grouping of children in the intervention group and the control group at baseline (T0)

Intake of foods by group (g)	Median (IQ range) of daily intake		
	Intervention n=84	Control n=83	P value*
Milk & dairy foods	53 (24-116)	60 (23-101)	0.771
Meat, fish and alternatives	120 (88-147)	108 (84-138)	0.357
Bread, other cereals & potatoes	294 (227-344)	314 (263-382)	0.041
Fruit and vegetables	112 (63-174)	138 (77-195)	0.178
Foods containing fat and sugar	240 (185-305)	212 (159-304)	0.510

* Mann-Whitney test of differences between intervention and control group

At baseline children in the intervention and control group were seen to be consuming most foods in the 'bread, other cereals and potatoes' group and least from the group containing milk and dairy foods. At baseline the median intake of fruit and vegetables by children in the intervention group was 112g/day and in control children 138g/day. Intervention group children were observed to be consuming a higher amount of foods from the 'bread, other cereals and potatoes' group (P=0.041).

Intake of foods within each of the five groups of the National Food Guide by the children at post-intervention are shown in Table 6.12 . At phase T1 children in the control group were seen to be consuming a greater amount of foods from the 'bread, other cereals and potatoes' group, which was not however, significant.

Table 6.12 Median (IQ range) of intake of food groups by National Food Guide grouping of children in the intervention group and the control group at post-intervention (T1)

Intake of foods by group (g)	Median (IQ range) of daily intake		
	Intervention n=84	Control n=83	P value*
Milk & dairy foods	40 (23-81)	55 (33-90)	0.029
Meat, fish and alternatives	147 (95-202)	140 (94-204)	0.820
Bread, other cereals & potatoes	353 (287-431)	378 (310-430)	0.334
Fruit and vegetables	137 (94-192)	146 (95-207)	0.285
Foods containing fat and sugar	218 (150-270)	228 (169-295)	0.278

* Mann-Whitney test of differences between intervention and control group

As at baseline, in both groups intake of foods from the 'milk and dairy foods group' was the lowest of the five groups, the data showing a median intake of 40g/day in the intervention group children and 55g/day in control. The data also show that both groups were consuming most foods from the starchy foods group and that the mean consumption of fruit and vegetables was close to that of meat, fish and alternatives.

Median changes in intakes of foods from each of the five groups of the National Food Guide by the children following the intervention period are displayed in Table 6.13. Statistical analysis of the data show that both groups increased their mean intake of starchy foods and that this increase was significant within both groups. The children also significantly increased their intake of foods in the 'meat, fish and alternative' group.

In the intervention group only, a significant decrease in the amount of foods that children were consuming from the 'milk and dairy foods' was observed between phase T0 and T1. A tendency in intervention children towards an increased mean intake of fruits and vegetables was revealed to be non-significant. Consumption of foods containing fat and sugar decreased by a median of 20g/day in the intervention group and by 13g/day in the control group.

There was a non-significant tendency towards decrease in intervention children. There were no significant differences between the intervention and control group in changes made by the children in intake of foods from the National Food Guide groups between baseline and post-intervention.

Table 6.13 Median (IQ range) of the change in daily intake of food groups by National Food Guide grouping of children in the intervention group and the control group between baseline and post-intervention (T1-T0)

Change in intake of foods by group (g)	Median (IQ range) of changes in daily intake					
	Intervention *n*=84	P value**	Control *n*=83	P value**	C v I$^{\Psi}$	P value*
Milk & dairy foods	-11 (-66-26)	0.034	-5 (-44-40)	0.683	17	0.218
Meat, fish and alternatives	+20 (-40-99)	0.007	+24 (-27-99)	0.005	12	0.862
Bread, other cereals & potatoes	+70 (13.6)	0.000	+54 (14.0)	0.000	8	0.496
Fruit and vegetables	+19 (-55-75)	0.100	+10 (-43-75)	0.148	37	0.790
Foods containing fat and sugar	-20 (-115-51)	0.080	-13 (-80-79)	0.371	10	0.514

*Mann-Whitney test of differences in changes between intervention and control group

**Wilcoxon test of differences within groups

$^{\Psi}$ mean difference of the differences in changes in control and intervention group (control value minus intervention value of change)

The children's intake of foods by sex from the 'milk and dairy foods' group of the National Food Guide at phase T0 and T1 is displayed by below in Figure 6-10 and intake of 'meat, fish and alternatives' by the sexes is displayed in Figure 6-11.

Figure 6-10 Median daily intake of milk and dairy foods (National Food Guide) of boys and girls in the intervention group (boys n=31, girls n=53) and the control group (boys n=31, girls n= 52) at baseline (T0) and post-intervention (T1)

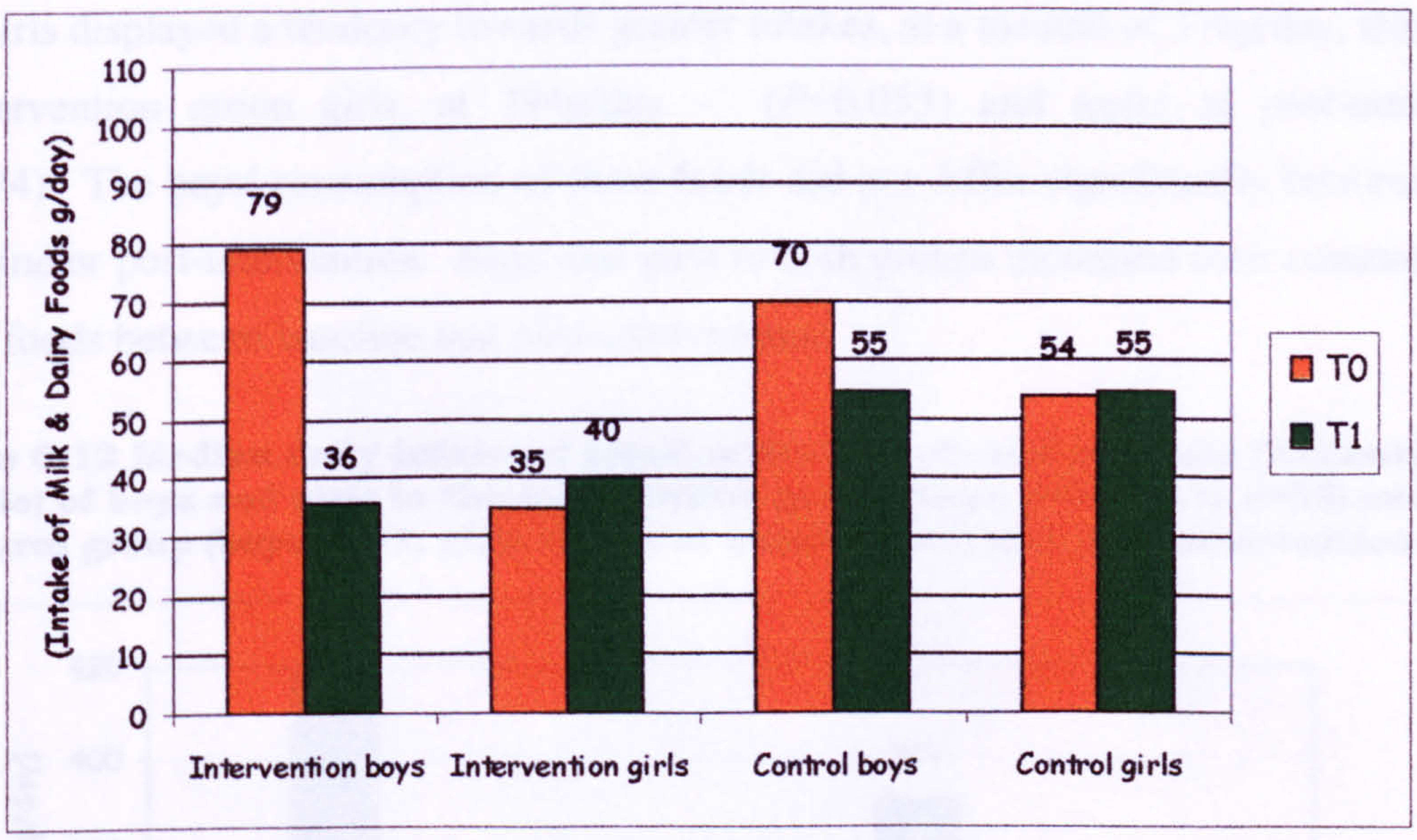
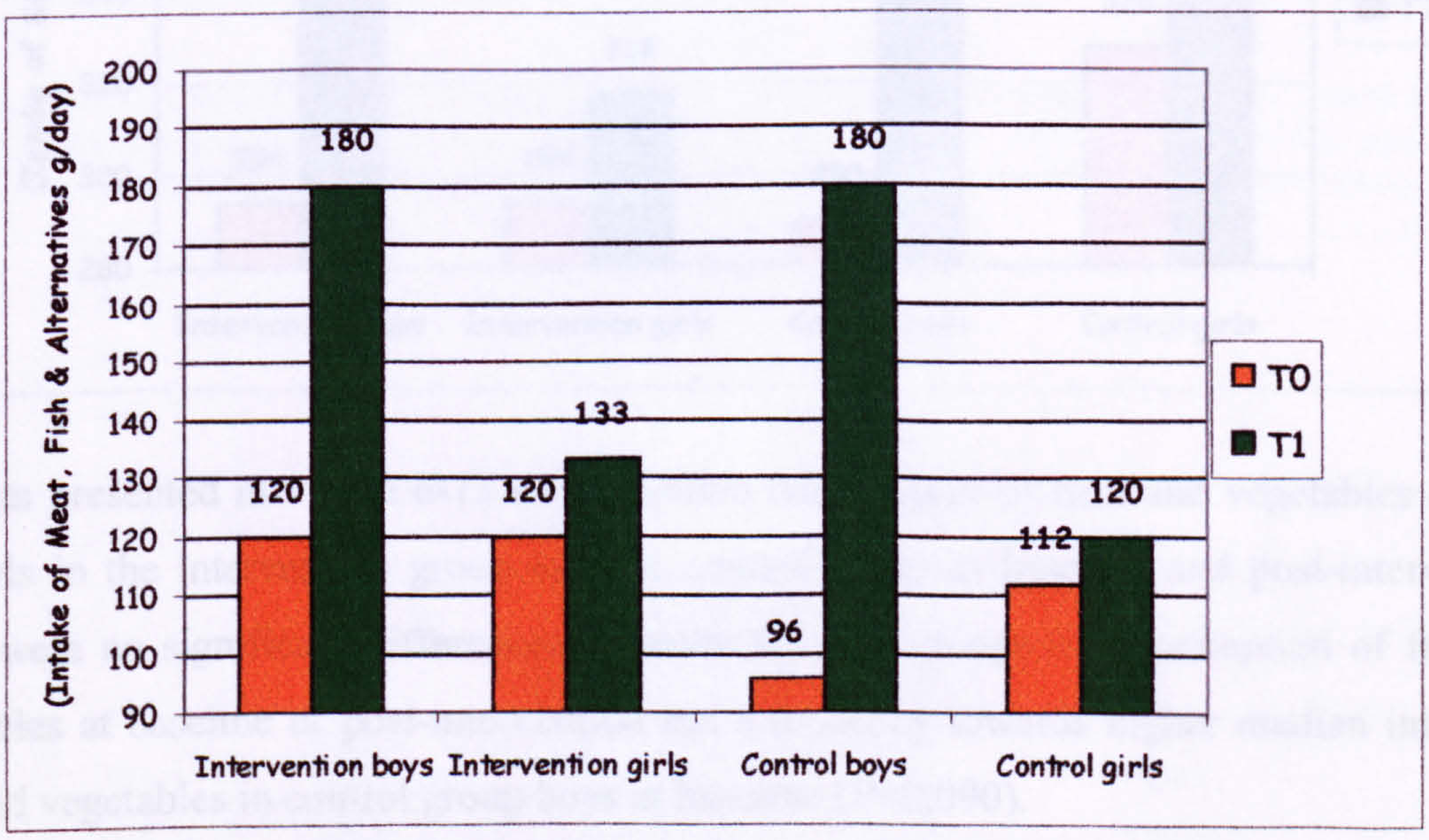


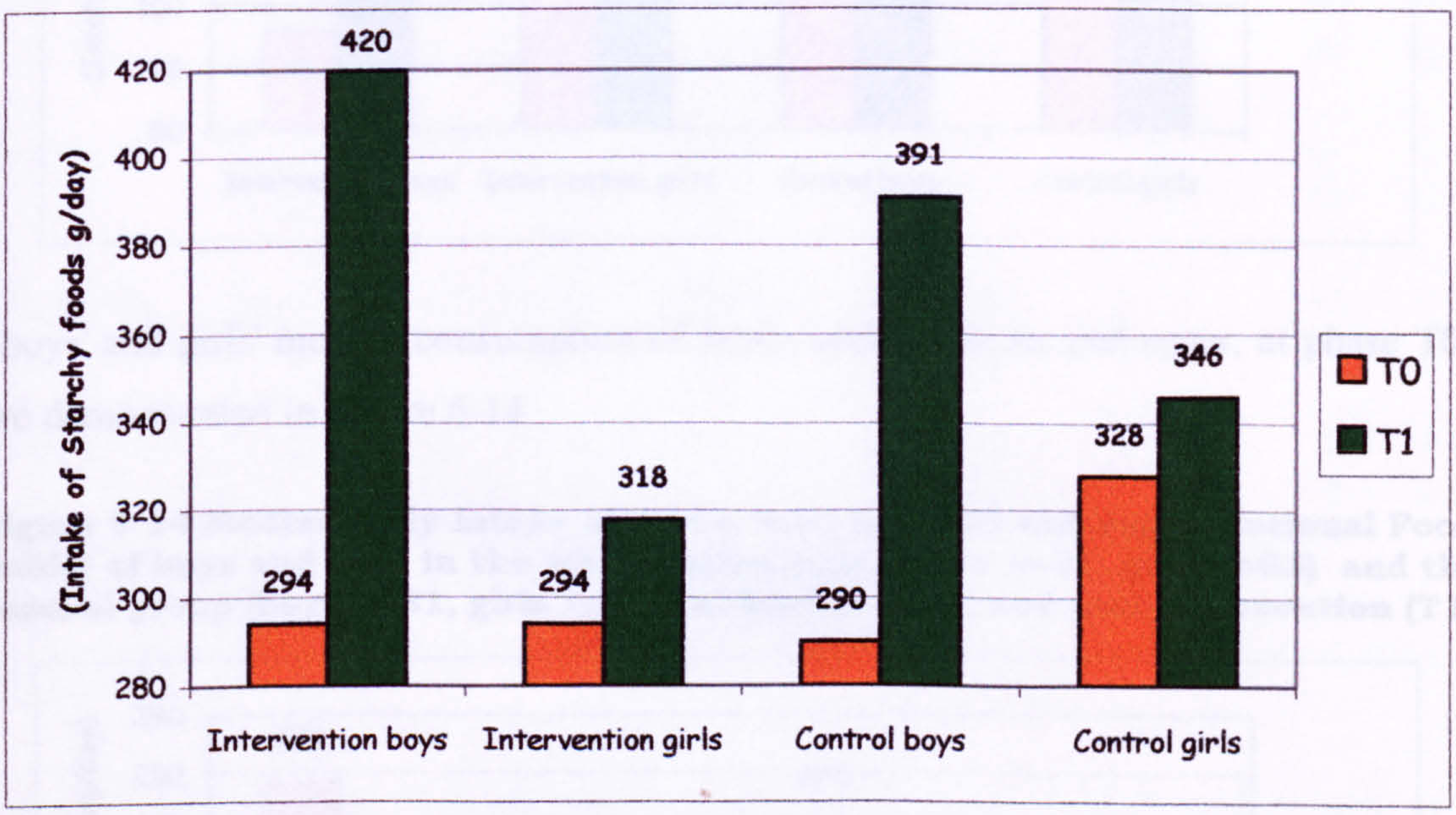
Figure 6-11 Median daily intake of meat, fish and alternatives (National Food Guide) of boys and girls in the intervention group (boys n=31, girls n=53) and the control group (boys n=31, girls n= 52) at baseline (T0) and post-intervention (T1)



Boys in both groups were consuming a larger amount of foods from the 'milk and dairy foods' group at baseline and post-intervention than girls. There was a non-significant tendency towards higher consumption of milk and dairy foods by boys in the intervention group. The differences in consumption of milk and dairy foods in girls from both groups at phase T0 and T1 were not found to be significant. The intake of meat, fish and alternative protein foods were not found to be statistically different between girls and between boys of the two groups, either at baseline or post-intervention.

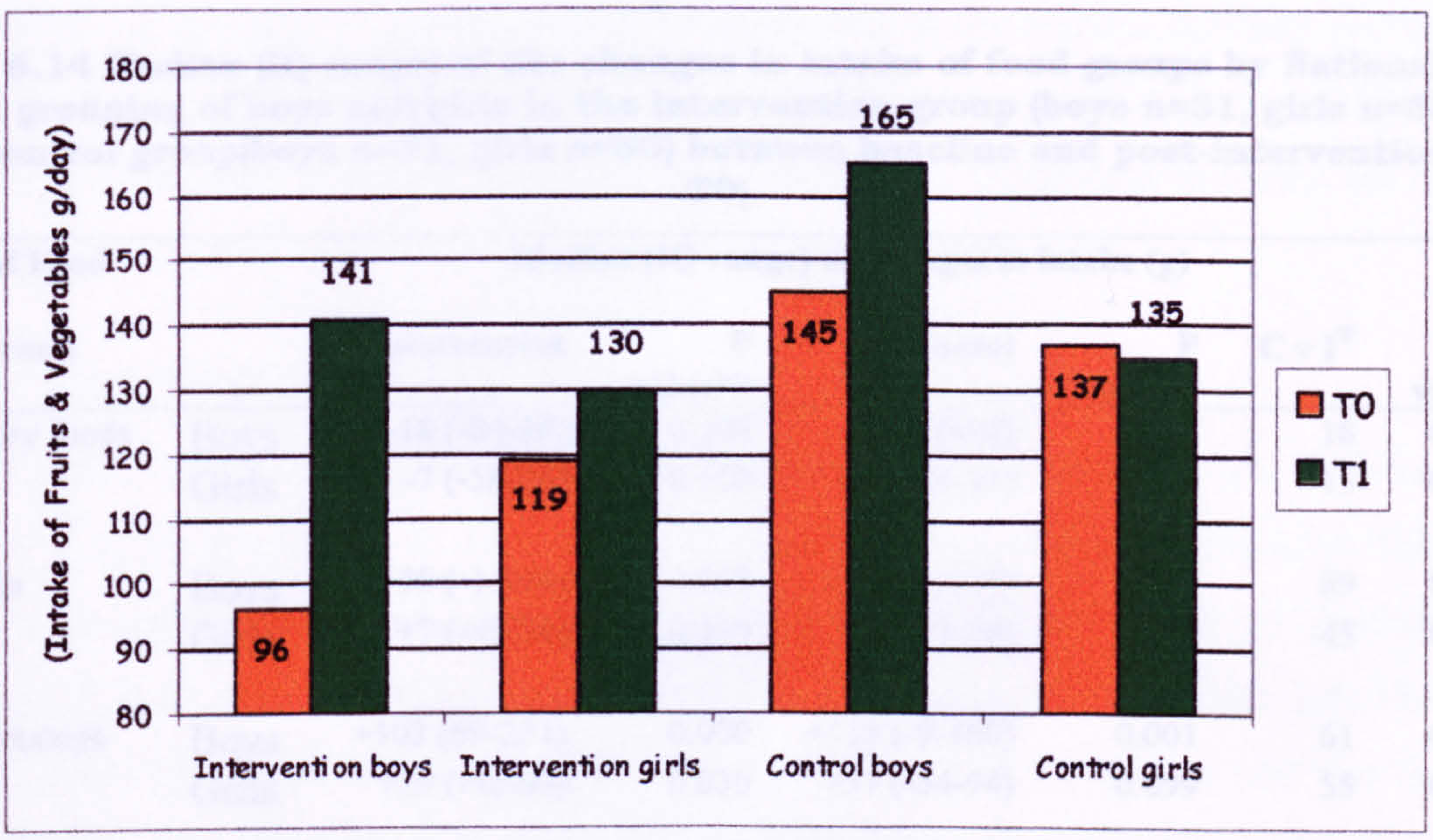
The children's median intake of foods from the 'bread, other cereals and potatoes' group is shown below in Figure 6-12 . At baseline, the consumption of these foods by the control group girls displayed a tendency towards greater intakes, at a median of 318g/day, than that of the intervention group girls, at 294g/day - (P=0.053) and again at post-intervention (P=0.074). The boys' consumption of these foods did not differ significantly between groups at baseline or post-intervention. Boys and girls in both groups increased their consumption of starchy foods between baseline and post-intervention.

Figure 6-12 Median daily intake of bread, other cereals and potatoes (National Food Guide) of boys and girls in the intervention group (boys n=31, girls n=53) and the control group (boys n=31, girls n= 52) at baseline (T0) and post-intervention (T1)



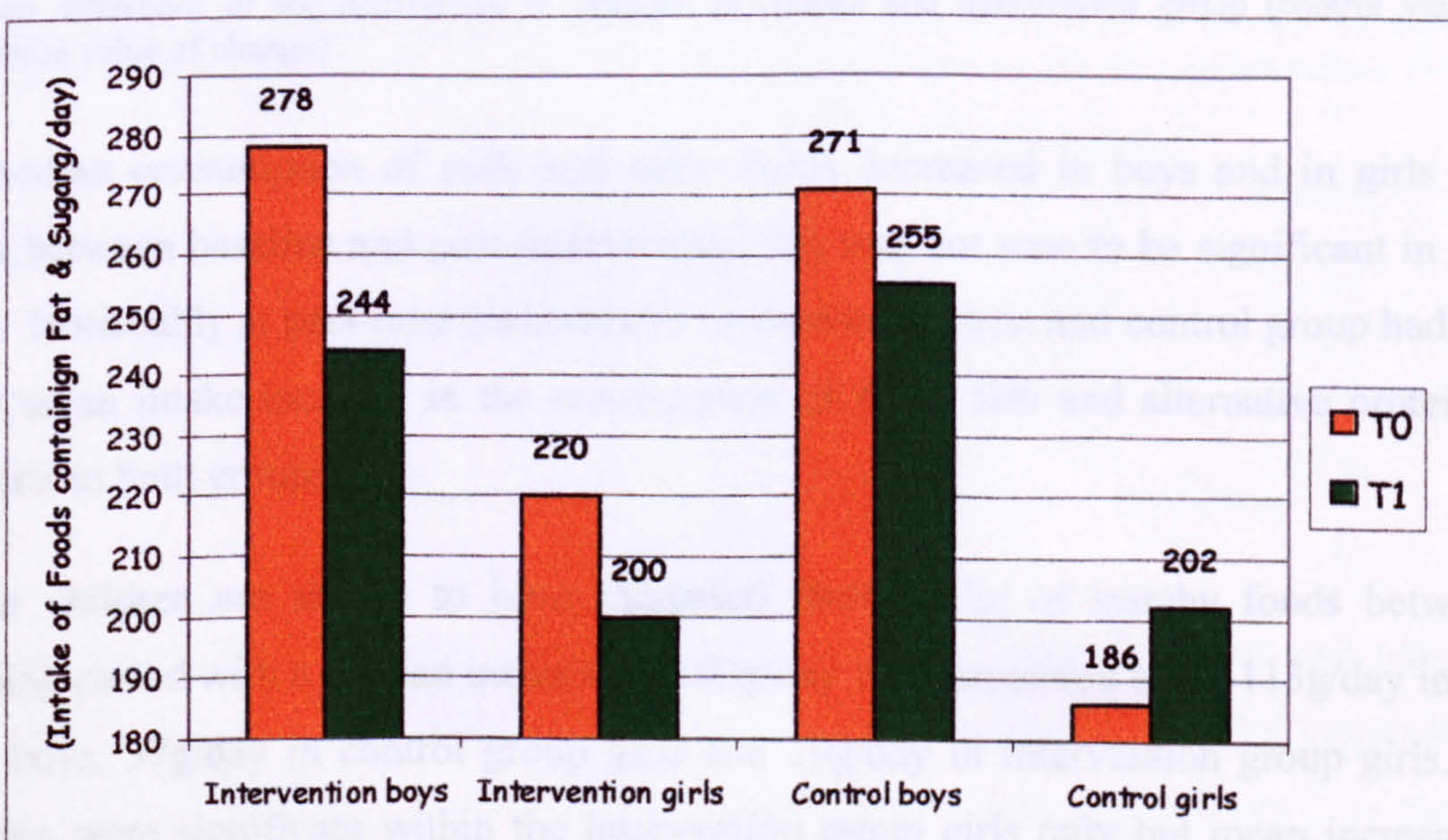
The data presented in Figure 6-13 show median daily intake of fruit and vegetables of boys and girls in the intervention group and the control group at baseline and post-intervention. There were no significant differences between the two groups in consumption of fruit and vegetables at baseline or post-intervention but a tendency towards higher median intakes of fruit and vegetables in control group boys at baseline (P=0.090).

Figure 6-13 Median daily intake of fruit and vegetables (National Food Guide) of boys and girls in the intervention group (boys n=31, girls n=53) and the control group (boys n=31, girls n= 52) at baseline (T0) and post-intervention (T1)



The boys' and girls' median consumption of foods containing fat and sugar, at phase T0 and T1 are demonstrated in Figure 6-14

Figure 6-14 Median daily intake of foods containing fat and sugar (National Food Guide) of boys and girls in the intervention group(boys n=31, girls n=53) and the control group (boys n=31, girls n= 52) at baseline (T0) and post-intervention (T1)



The data show that intakes of these foods were lower at post-intervention in boys and in girls in both groups than at baseline. There were no significant differences, however, between median intake of foods containing fat and sugar between groups at either phase. Mean (SE) of the changes in the consumption of foods in each of the five groups of the National Food Guide are presented by sex in Table 6.14 .

Table 6.14 Median (IQ range) of the changes in intake of food groups by National Food Guide grouping of boys and girls in the intervention group (boys n=31, girls n=53) and the control group(boys n=31, girls n=53) between baseline and post-intervention (T1-T0)

National Food Guide Food Group		Median (IQ range) of changes in intake (g)					
		Intervention	P value**	Control	P value**	C v I$^{\Psi}$	P value*
Milk/dairy foods	Boys	-18 (-84-38)	0.104	-2 (-40-34)	0.875	18	0.269
	Girls	-7 (-58-25)	0.150	-11 (-45-41)	0.669	15	0.538
Meat/fish	Boys	+50 (-1-164)	0.003	+99 (-8-139)	0.006	89	0.804
	Girls	+7 (-45-74)	0.319	+5 (-37-74)	0.278	45	0.967
Bread/potatoes	Boys	+103 (69-251)	0.000	+113 (-9-160)	0.001	61	0.443
	Girls	+29 (-42-89)	0.030	+37 (-54-94)	0.099	55	0.895
Fruit/vegetables	Boys	+39 (-10-138)	0.004	+2 (-59-58)	0.754	48	0.053
	Girls	+7 (-71-70)	0.815	+22 (-28-82)	0.119	18	0.273
Foods/fat & sugar	Boys	-22 (-116-54)	0.272	-14 (-80-60)	0.410	21	0.751
	Girls	-19 (-116-50)	0.161	-2 (-88-86)	0.597	43	0.573

* Mann Whitney test of differences between the intervention and control group by sex
**Wilcoxon test of differences in changes within boys and within girls

Ψ mean difference of the differences in changes in control and intervention group (control value minus intervention value of change)

The median consumption of milk and dairy foods decreased in boys and in girls of both groups between baseline and post-intervention, this was not seen to be significant in any one group. Noticeably at post-intervention boys in the intervention and control group had a much higher mean intake increase in the consumption of meat, fish and alternative protein foods than girls in both groups.

All the children are shown to have increased their intake of starchy foods between the recording period with a median increase of 103g/day in intervention boys, 113g/day in control group boys, 37g/day in control group girls and 29g/day in intervention group girls. These increases were significant within the intervention group girls only but mean increases were not revealed to be significantly different between girls in the two groups.

The largest increase in the consumption of fruits and vegetables was demonstrated by boys only in the intervention group with a mean increase of 39g/day - this was significant at

P=0.004 (Wilcoxon signed rank test for differences within groups) and a tendency towards a higher average increase in the consumption of fruits and vegetables was also shown in intervention group boys (P=0.053 - Mann Whitney test of differences between groups). All the children decreased the amount of foods they were consuming that contained fat and sugar, however, the decrease was very small and not found to be significant in either sex between either the two groups.

6.3.3 Micronutrient Intake

Median intakes of betacarotene and vitamin C, together with the intake of iron and calcium at baseline (T0) by the children in the intervention and control group are displayed in Table 6.15 . (For more detailed information on intake of a wider range of vitamins by the children of the intervention and control group please refer to pages 251 to 259). These data show that median intake of betacarotene at baseline was similar between the groups and that the range of intake was wide. Children in the intervention group had a median daily vitamin C intake of 62mg/day and the control group 69mg/day. The daily intake of iron in the diets of the children in both groups was 9mg/day. There were no specific differences in median daily intake of any micronutrient at baseline between the two groups (using Mann Whitney test for differences between groups).

Table 6.15 Median (SD) of daily intake of selected vitamins and minerals of children in the intervention group (n=84) and the control group (n=83) at baseline (T0)

	Median (IQ) of daily intake		
	Intervention n=84	Control n=83	P value*
β-carotene (μg)	941 (557-1256)	984 (518-1491)	0.677
Vitamin C (mg)	62 (38-99)	69 (45-107)	0.292
Iron (mg)	9 (8-11)	9 (8-11)	0.806
Calcium (mg)	646 (535-843)	692 (529-920)	0.455

* Mann Whitney test of differences between intervention and control group

Post-intervention median daily intakes of betacarotene, vitamin C, iron and calcium are shown in Table 6.16 . The range of intake of betacarotene was large in the intervention and control group. A tendency towards higher median daily intakes of vitamin C in the control group were observed (P=0.021 Mann Whitney test). The median daily intake of calcium in the intervention group children was 698mg/day and in the control children 772mg/day. The trend towards higher intakes of calcium in the control group at post-intervention were found to be significant at P=0.059.

Table 6.16 Median (IQ range) of daily intake of selected vitamins and minerals of children in the intervention group (n=84) and the control group (n=83) at post-intervention (T1)

	Median (IQ range) of daily intake		
	Intervention n=84	Control n=83	P value*
β-carotene (μg)	988 (685-1449)	1136 (711-1855)	0.165
Vitamin C (mg)	66 (40-97)	79 (52-120)	0.021
Iron (mg)	9 (8-12)	10 (8-12)	0.201
Calcium (mg)	698 (555-886)	772 (579-983)	0.059

* Mann Whitney test for differences between intervention and control group

The median (IQ range) changes in intake of betacarotene, vitamin C, iron and calcium are presented in Table 6.17. An increase in daily intake of betacarotene was observed in the intervention group children, of 59μg/day (P=0.067). A non-significant tendency towards an increase in median daily intake of vitamin C was seen in the control group children only. Daily intake of iron in the diets of the intervention group children was stable but significantly increased by 1mg/day in the control group (P=0.001). Again, in the control group only, the median increase in daily calcium intake of 77mg/day was also revealed to be significant at P=0.020. There was a non-significant tendency towards a higher median increase in intakes of iron in the control group, above that of the intervention group but no further significant results revealed in increased intakes between groups.

Table 6.17 Median (IQ range) of the change in daily intake of selected vitamins and minerals of children in the intervention group (n=84) and the control group(n=83) between baseline (T0) and post-intervention (T1)

	Median (IQ range) of daily intake					
	Intervention n=84	P value**	Control n=83	P value**	C v I[Ψ]	P value*
β-carotene (μg)	+59 (-406-628)	0.067	+191 (-425-994)	0.252	16.5	0.489
Vitamin C (mg)	-1 (-27-32)	0.735	+12 (-15-39)	0.069	15	0.317
Iron (mg)	0 (-2-3)	0.422	+1 (0-3)	0.001	1.0	0.096
Calcium (mg)	+13 (-107-166)	0.361	+77.2 (-98-268)	0.020	39	0.164

* Mann Whitney test for differences in changes between intervention and control group

** Wilcoxon signed rank test of differences within groups

Ψ mean difference of the differences in changes in control and intervention group (control value minus intervention value of change)

6.4 Discussion

A total of 171 children completed two food diaries at baseline and two following the intervention period. The children appreciated the size and portability of the food diaries but the quality of recording by the children varied tremendously and this made the interview on the day after completion extremely important in order to clarify entries. The majority of interviews with children took place in school during lesson time but a percentage of interviews had to be conducted at break-times and lunch-times when a small number of pupils were refused permission to leave the classroom.

In the first few weeks a valuable lesson was learnt by the researcher in terms of children forgetting to bring their food diary with them to school on the day of interview. Initially this resulted in children quite happily attending interview without bringing a food diary. In order to minimise the wasting of lesson time spent in unfruitful transit and empty appointments a system of reminders evolved that succeeded in reducing the number of food diaries left at home. The reminder system had to work on several levels - a notice to teaching staff arranging appointments on the researcher's behalf and reminder slips to the children themselves. Teaching staff were politely reminded that interviews would need to be performed on a certain day and received a full explanation as to why the date of interview was important to the quality of dietary data collected.

A printed A4 notice of the day of the interviews was delivered to school well in advance to be displayed on the notice board in the staff room. Appointments slips were printed, completed and delivered to the appropriate member of staff in school and were placed in the registers of the children who were to be interviewed the next day (on the third day of the diary or on Friday for diaries collected on Monday morning). This strategy proved most successful in reminding the majority of children that they needed to ensure that they bought their diary to school. For those children who repeatedly forgot, a reminder slip was posted to their home address. This in itself was fraught with difficulty as the children who most often forgot were those children with transitory home circumstances which augmented the problem of contacting the children.

In addition to children forgetting their diaries, at the beginning of the distribution and collection period many children, on their way to an interview, were intercepted by concerned members of school staff and returned to their classrooms. To counteract this effect upon the interviews, release slips were printed, completed and signed by the researcher and these also put in the form registers of children who were to attend an interview. The children were then able to show the slip to any member of school staff who enquired about their purpose. Every attempt was made to inform teaching staff on the necessity and duration of interviews with their pupils as it became apparent that all schools need to know the location of their pupils at all times. Quite often children reported that they were extremely pleased to have a legitimate reason to leave the classroom and meander in the school corridors and very often talked about taking the longest possible route back to their lessons!

The interviews took between 20 and 40 minutes depending on the amount of detail recorded by the children and the time the children spent considering portion sizes in the photographic food atlas. Standard portion sizes of school meal items were ascertained from catering staff in each school taking part in the study as servings were reported by the catering staff to be standardised for each child.

Many foods consumed by the children frequently were not depicted in the food atlas and many other foods within the atlas were not frequently consumed by the children. Frequencies of food consumption could be assimilated from studies of dietary intake in children and used to develop a specialised food atlas that would also contain foods that are consumed away from home.

When performing a dietary survey of nutrient intake in children, the literacy and numeracy skills of the children may require that additional provision be made for children with special educational needs. During the adaptation of the food diaries used in this study, the proof copies were shown to several members of teaching staff who gave valuable and constructive criticisms of the style of the diary and the language used within it. Several changes were made on the basis of recommendations. It is to be expected that in schools in socially deprived areas a percentage of the school role will have been identified as having special educational needs either at primary school or on entering secondary school and this data is available from the Special Needs Co-ordinator in school. It is likely that in any one prospective sample of children that a percentage will have a reading age below the average or below that expected in children of a similar age. Some examples of change applied to the food diaries was the replacement of the word 'estimate' in the context of" estimate the amount of food that you consumed" with "use your best guess". The word 'describe' was replaced by "tell us" and 'origin of food' was replaced by "where was the food from?".

In summary, several changes were made to the food diaries to better suit the abilities of the children participating in the study and this should be considered at the planning stage of any study in socially deprived children. The children appeared to find the diaries easy to use but easy to forget about on the day of interview. A system of appointments that are known to the subjects and to teaching staff at school, with notification well in advance was found to reduce the number of forgotten diaries and missed interviews.

In a dietary survey including children and adolescents from socially deprived backgrounds, it may be expected that a proportion of the children will have some difficulty with literacy and numeracy. Young people with poor literacy and numeracy skills may require assistance from an adult, perhaps a parent, sibling or teacher in the completion of a food diary (Macario *et al*, 1998). In cases such as these, the recording may be a challenge and may be assisted with the use of a dietary diary with room for drawings. Computerised food diaries that provide a selection of food and beverages, accompanied by photographs, that may be selected by an individual may be a method of overcoming the obstacles presented by the amount of writing a person may have to do. This may be a highly attractive alternative for young people with low literacy levels but who have fewer problems with computer literacy. This method would require access to a computer with the appropriate dietary diary programme or access to a lap-top computer or even a hand-held computer, but may be feasible to run on a community or school basis. At the present time there are no published studies on the use of purpose-written computer programmes for the collection of dietary data in children and adolescents.

For this study, 850 food diaries were printed and bound at baseline but 500 of these were used in the baseline recording period because of losses. The printing of diaries may some considerable cost to the budget of smaller studies and the number of losses to be borne must be accounted for.

6.4.1 Intake of Nutrients

The suitability of estimated food diaries in the surveying of dietary intakes is discussed in Hackett *et al*, 1983 and for this study further discussed in Part B - Validation of Methodology but it is concluded that in this study the food diaries were an efficient method of collecting dietary data from children in a sample size of approximately 200.

Nutrient intakes were reported as observed in the children. No inference is made to absolute intakes and the data serve to show an overview of the macronutrient and micronutrient intake in children in socially deprived areas of Tyne and Wear and the intake of nutrients prior to and following a school-based food preparation skills intervention. The mean energy intakes of children participating in this study at both baseline were 8.6MJ/day in both the intervention and control group and at phase T1 9.1MJ/day in the intervention group and 9.4MJ/day in the control. It is difficult to make comment on the adequacy of nutrient intakes when commonly, daily energy intake is reported by sex as the energy requirements of boys and girls differ at this age. Analysis of the data by sex show that mean energy intake of boys at baseline was 9.9MJ/day and at post-intervention 10.6MJ/day in intervention group boys and 10.8MJ/day in control. These values are higher than the mean value reported in the NDNS for boys aged 11-13-years-old (8.28MJ/day). In girls at baseline mean energy intakes were estimated to be 7.8MJ/day in intervention group girls, 7.9MJ/day in control. These values increased to 8.2MJ/day and 8.5MJ/day at phase T1 respectively. Mean baseline and post-intervention energy intakes were higher than values reported in the NDNS (7.03MJ/day in girls), by Adamson *et al*, 1992a (8.61MJ/day in boys aged 11-12-years-old and 8.27MJ/day in girls of the same age range) and by Doyle *et al*, 1994 (9.13MJ/day in 12-13-year-old socially deprived boys and 7.90MJ/day in girls). The data presented in this study are encouraging because, data are presented as observed and at group level, mean energy intakes indicate that the method of dietary assessment was effective in estimating mean intake of energy in the children and questions are not raised about the impact of under-reporting on the dietary data.

Mean energy intakes increased between baseline measurement and post-intervention measurement, in children of both groups, as would be expected in children of this age. At baseline the children were deriving 12.3% of their total daily energy from protein. At post-intervention the contribution increased to 13.1% in the intervention group and 13.0% in the control. The contribution of protein to daily energy intake in the children taking part in this study is comparable to data in the NDNS where protein was found to contribute 13.1% in boys and 12.7% in girls to total daily energy intake. Protein intakes (g/day) increased in both sexes in both groups between phases T0 and T1. The increase in protein intake was highly significant in both of both groups and in control girls only. The observed increase in the amount of protein the children were consuming was also reflected in the increase in the percentage contribution of protein to the diets of the children at post-intervention. Both groups demonstrated a 0.7% increase in the contribution of protein to energy intake. No significant differences were observed in the protein intake (g/day) or in the percentage contribution of protein to the children's diet between the intervention and control group and thus it is concluded that the practical food skills intervention did not impact upon the protein intake of the children.

The mean increase in intake of total fat (g/day) in children intervention group was 6g/day and slightly less than the mean increase of 9g/day in the diets of children in the control group. The difference in mean increase was not, however, found to be statistically significant. The contribution of total fat to total daily energy remained stable in the intervention group at 36.3% between baseline and post-intervention but there was a minor increase, but not significantly so, in children in the control group from 35.3% to 35.9% of total daily energy derived from total fat. The percentage energy provided by fat in the children's diets at baseline and post-intervention are favourably comparable to the DRV of 35% for total fat in groups not consuming alcohol (Department of Health, 1991). The contribution of fat to energy intake in these children is comparable to that reported in the NDNS by Gregory *et al* (2000) for children aged 11-14-years. Gregory *et al* reported the contribution fat to be 35.2% in boys and 36.2% in girls whilst Doyle *et al* (1994) report values of 36.6% in boys and 35.7% in girls. Robson *et al* (2000) reported median percentage contribution of total fat to total daily energy in the diets of Northern Irish adolescents to be higher still at 39% in boys aged 12-years-old and at 38.4% in girls.

The intake of saturated fat by the children increased in both groups between recording periods. Intake of saturated fat was not found to be significantly different at either baseline (P=0.467) or at phase T1 (P=0.664) between the intervention and control group. Within groups the children demonstrated an increase in the amount of saturated fat in their daily intake which was significant at P=0.001 (intervention group) and P=0.024 (control group) with a t-test of differences showing a tendency towards higher intakes of saturated fat in the intervention group at post-intervention. T-test of differences in changes between the intervention and control groups however, was not found to be of statistical importance.

The contribution of saturated fat to total daily energy intake also increased in children of both groups between the recording periods. A baseline children in the intervention group were deriving an estimated 12.1% of their total daily energy from saturated fat, in the control group the value was 11.8%. At post-intervention the contribution of saturated fat increased these figures to 12.5% in the intervention group and to 11.9% in the control. The DRV for the contribution to energy by saturated fat in population groups not consuming alcohol is 11%. The children participating in this study were shown to be deriving more than 11% of their dietary energy from saturated fat. These values are lower, however, than those reported by Gregory *et al* (2001) where saturated fat contributed 13.8% to total daily energy in boys and

14.0% in girls. In 12-13-year-old children Doyle *et al* (1994) reported saturated fat as contributing 13.1% of total daily energy in boys and 13.2% of energy in girls. The changes in the contribution of saturated fat to energy in the diets of the children were not found to be statistically significant and it is concluded that the intervention did not impact upon the intake of total fat or saturated fat in the diets of children in the intervention group.

The children's intake of carbohydrate significantly increased by a mean of 14g/day ($P<0.001$) from a mean 272g/day at T0 to 287g/day in the intervention group and by a mean of 18g/day from a mean of 272g/day at T0 to 296g/day in the control group (P=0.030). The percentage of daily energy derived from carbohydrate in the children's diets was approximate to 50% in both groups at phases T0 and T1. Both groups showed a small decrease in the amount of energy contributed by carbohydrate between the two recording periods but this was not found to be significant within either group nor was it significant between the two groups (P=0.460). The mean intake of starch by the children increased slightly but significantly within the intervention and control group.

Starch contributed 28% of total daily energy in both groups at baseline and 29% of energy at post-intervention. T-test of differences in changes in intake of starch and the contribution of starch to total daily energy intake between the intervention and control group revealed that the changes were not statistically significant and it is concluded that the intervention did not impact positively upon the intake of total carbohydrate and starch in the diets of intervention group.

Intake of total sugars and non-milk extrinsic sugar are presented and discussed in Chapter 8.

The analysis of data categorised by the five food groups of the National Food Guide reflect and the changes in macronutrient intake by children in both groups and present some further more interesting findings. Both groups show a significant increase in their mean intake of foods in the 'meat, fish and alternatives' group and this further demonstrates the increase in protein in the diets of the children with a significant trend towards higher intakes in children of the intervention group. Similarly, the children significantly increased their intake of starchy foods with a significant trend towards higher intakes in control group children at phase T1. Both groups decreased their consumption of foods belonging to the 'foods containing fat and sugar' group, but the decrease was small in both groups, amounting to approximately 6% and the decrease is not reflected in the children's intake of fat or saturated fat. In terms of g/day per day, children were making most selections from the starchy foods group followed by the group of foods containing fat and sugar. The children were consuming slightly less foods from the groups of foods containing fat and sugar than they were from the starchy food group.

In both groups at phase T1 children were consuming approximate amounts of protein to their consumption of fruit and vegetables. One important revelation was that children in both groups were consuming a very small amount of foods from the 'milk and dairy foods' groups. Boys in the intervention groups increased their intake of fruits and vegetables by 39g/day (P=0.004) and a trend towards increased intake in fruits and vegetables by boys only in the intervention group compared to boys in the control group was revealed (P=0.053). The analysis of foods consumed by the children according to the five groups of the National Food Guide show that the intervention had a positive impact upon the intake of fruits and vegetables in boys who attended the Food Club. The intake of fruit only by the children are presented in Chapter 7 (see 8.3.6) but equate to less than half a portion per day in both groups.

There were no significant differences in increase in intakes of betacarotene, vitamin C, iron and calcium between the control group and intervention. The Food Club did not, therefore, have an impact upon the intake of these vitamins and minerals by children who attended the Club.

The analysis of foods consumed by the children in accordance with the National Food Guide show limited consumption of milk and dairy foods - less in both groups than a very small glass of milk or a small pot of fromage frais. Low intakes of milk and dairy foods are reflected in the children's intake of calcium at phase T0 and T1. These children are entering a period of rapid growth and optimal calcium intakes are preferable if they are to achieve peak bone mineralisation. Boys were seen to have higher intakes of iron than girls, although this is likely due to higher mean daily energy intakes.

The intake of iron during the recording period was sub-optimum in girls and did not increased significantly even though the girls had increased their mean energy intake between baseline and post-intervention. The median intakes of fruit and vegetables were sub-optimal within both groups at both phases and equate to between 1 to 2 portions of fruit and vegetables per day (including fruit juices). There is evidence to show that boys only in the intervention group significantly increased their intake of fruits and vegetables following the intervention.

The data show that the intake of nutrients were similar in the intervention group and control group children at baseline and following intervention. Mean energy intake increased in both sexes in both groups, as may be expected in children of this age and intakes of macronutrients were comparable to other published data on dietary surveys of children of similar age.

In summary, comparison between the data on changes in nutrient intake following intervention, as presented here, to other studies of practical food and nutrition intervention in children is not possible as similar studies have not been published. The data support previous findings in that the intake of some micronutrients and of fruits and vegetables in children from socially deprived backgrounds is sub-optimal. The intervention did not effect the nutrient intake of children in the intervention group but it did have a positive impact upon the consumption of fruits and vegetables of boys who attended the Food Club.

7 Comparison of reported energy intake with physical activity level

" a major conclusion of recent studies is that energy intakes have declined in response to a secular trend towards lower amounts of activity in children"

Livingstone *et al*, 1992

"there is no gold standard that can be used to validate prospective methods of dietary assessment that can be carried out in free-living subjects"

Bingham & Day, 1997

7.1 Introduction

It is now accepted that there is a bias towards underestimation of energy intake through self-reports of diet in some age groups (Black *et al*, 2000, Livingstone *et al*, 1992). For example, in the NDNS, Gregory *et al* (2001) comment on under reporting by older girls, evidence of which became apparent in mean energy intakes. This presents a paradox; an increased incidence of obesity in children that is coupled by falling values of reported mean energy intake. Under-reporting may take several forms; intentional under-reporting, intentional alteration of diet and unintentional/unknowing under-reporting. In order to identify biased reporting at the individual level it is necessary to measure either energy expenditure or record a detailed history of physical activity during the time of dietary analysis. Either of these methods are probably achievable in clinical conditions but may be particularly difficult in free-living individuals. At the present time there are no clear trends in under-reporting in studies assessing the diets of individuals of lower social class. Common validation techniques involve the use of anthropometrical measurements to calculate the ratio of energy intake to basal metabolic rate which is expressed as the physical activity level (PAL), and serves as a check on the accuracy of self-reporting (Zemel *et al*, 1997).

The analysis of urinary biochemical markers, such as 24hour urinary nitrogen excretion (Bingham & Day, 1997, Black *et al*, 2000) and 24h urinary creatinine excretion (Ritchey *et al*, 1973, Narayanan & Appleton, 1980) are common validation techniques. Urinary creatinine may be viewed as a more reliable technique since creatinine is generally stable and does not decompose within the time of a 24-hr collection and has been shown to be more robust against intra-individual variation (Bingham *et al*, 1988). More recent techniques include a doubly labelled water method which has been employed successfully as a means of validating dietary energy intake in adults (Black & Cole, 2000 and Black *et al*, 2000) and in children (Livingstone *et al*, 1992).

Biochemical markers are useful in that they reflect intake without relying upon (self) reports of food consumption. An analysis of biochemical markers may include quantifying plasma vitamin C, serum carotenoids and tocopherols (Bingham & Day, 1997) and serum ferritin, folate and vitamin A (Doyle *et al*, 1994).

In dietary assessment of children, validation techniques may include the quantification of 24h urinary nitrogen excretion (Ritchey *et al*, 1973) and urinary creatinine (Bingham &

Cummings, 1985) which has been shown to be clearly correlated with total protein intake and animal protein intake. Common problems in validation techniques that rely upon 24h-urine collection are non-compliance of children in missed micturitions causing unknown losses (Neubert & Remmer, 1998).

7.1.1 Ratio of Mean Energy Intake to Basal Metabolic Rate

Bingham (1987) suggests that PAL values of less than 1.4 times the BMR for any given group suggests under-reporting of energy intake whilst Livingstone *et al* (1990) suggest 1.3 times mean measured energy intake to be compatible in a sedentary adult. The Department of Health confers physical activity levels (PAL) of 1.56 for boys and 1.48 for girls, assuming a moderately active lifestyle in adolescents aged 10 to 18 years (Department of Health, 1991).

7.1.2 Urinary biochemical markers

Urinary nitrogen, in the form of urea, may be determined instrumentally by a process of acid digestion and titration of free ammonium and is a common analysis performed in the medical biochemical laboratory. A quantitative determination of urea nitrogen can be performed and a calculation applied to adjust total urinary nitrogen to dietary protein by a factor of x6.25 (a mean factor for food stuffs, although individual factors exist for many other foods, particularly those rich in protein, for example, meat, fish and fowl). Urinary nitrogen (g/24hr) may be correlated with estimated protein intake (g/day) of recorded dietary intakes in a healthy adult population (Black *et al*, 1991). However, the same degree of correlation will not be demonstrated in *healthy* children and adolescents during growth periods, where demand for protein for growth exists, wherein a larger deficit in urea nitrogen may be observed due the effect upon nitrogen balance. The correlation between dietary intakes nitrogen and 24-hr nitrogen excretion in free-living adults completing estimated food diaries is suggested to be greater than 0.70 (using Pearson's correlation) (Bingham & Day, 1997).

Urinary creatinine excretion (mg/24hr) may be investigated in the evaluation of protein nitrogen intake by subjects. The effect of diet on urinary creatinine excretion relates specifically to 3 dietary components – protein, creatine and creatinine. The strongest acute effect upon urinary creatinine excretion occurs during the heating process of meals containing protein Nuebert & Remer (1998). When adjusted for fat-free mass and controlling for age dependency, creatinine excretion can be successfully correlated with total protein intake and animal protein intake. Quantitative determination of 24-hr urinary creatinine excretion may be more useful in studies of children and adolescents, providing suitable reference values for this analyte can be found in the literature. Creatinine coefficients which express the amount of creatinine excreted in 24hr by a healthy individual (expressed as mg/kg body weight/24 hr) have been shown to correlate well with body weight but better still with muscle mass (an obese individual would be expected to have a lower creatinine output than a lean individual of equal body mass).

The ratio of sodium to potassium (excretion mg/kg body weight/24hr) may be used as a marker of fruit and vegetable intake. The ratio depends on the intake of vegetables and fruit and assumes that, within a given range in *healthy* children, the sodium: potassium will demonstrate a greater value in individuals consuming greater amounts of vegetables and fruits (g/day) and a lower value in individuals consuming smaller amounts as recorded in estimated food diaries.

7.1.3 Aims

- **The specific aims of this work were to compare the reported energy intake of subjects to Physical Activity Level and to perform a preliminary analysis of 24-hour urine sample biochemical markers**

7.2 Methods

An evaluation of the method of dietary assessment (3-day estimated food diaries) was carried out using two techniques. The first examined the ratio of Basal Metabolic Rate to Mean Energy Intake (MJ/day) which is expressed as the physical activity level (PAL) and serves as a check on the accuracy of self-reporting.

The second technique was performed on a sub-sample of subjects and employed a quantitative analysis of 24-hr urinary nitrogen and creatinine, sodium and potassium in a 24-hr urine sample collected from this sub-sample.

A 25% sub-sample (i.e. 50 subjects, five children from each of the ten schools) of the study group were required to provide an adequate sub-sample to measure the accuracy of estimating actual dietary intake using the interview method. Each subject agreeing to provide a urine sample was asked to collect all urine passed within a specified a 24-hr period on the weekend day of food diary nos. 1 and 2 (e.g. Saturday or Sunday).

A letter detailing the requirement for the sample was sent to all parents and guardians of children who volunteered to take part in the Good Food Study. This letter asked the parents of children to agree to their child providing a sample and was accompanied by a detailed information sheet (see Figure 7-1) and a parental consent form (see Figure 7-2).

Figure 7-1 Subject information sheet (24-hour urine sample)

Human Nutrition Research Centre
Wellcome Laboratories
Queen Victoria Road
Newcastle upon Tyne
Tel: 0191 222 8241

Providing a 24-hour urine sample
INFORMATION SHEET

This information sheet contains details about providing a 24-hour urine sample. Please read it carefully before you consent to your child providing a sample. If you have any questions about the 24-hour collection, please telephone the number given at the bottom of this sheet. Providing a 24-hour sample urine is entirely voluntary. All the information your child supplies will be strictly CONFIDENTIAL. Your child may withdraw from providing a sample at any time without giving a reason.

- A Nutritionist, Mrs Sam Revill or Miss Julie Hooper, will contact you at home to ask to visit you and your child at a mutually convenient time.
- The Nutritionist will explain to you and your child what a 24-hour sample of urine is and how it would be collected.
- The urine collection would be done on a Saturday or Sunday when your child is completing a Food Diary. This means that your child will not have to take any equipment with them to school.
- The Nutritionist will supply your child with a large, sealable plastic container to store the sample in. She will also give your child a smaller, portable plastic container and a jug.
- The large container can be safely sealed and will contain a preservative inside it. The container can be stored in the bathroom or toilet whilst the collection is in progress.
- Your child will be asked to take three tablets (PABA tablets) on the day of the collection – one at breakfast, one at lunchtime and one in the evening.
- PABA tablets are used to check that the 24-hour sample is complete.
- PABA tablets contain a substance that is very like Vitamin B. PABA tablets have been used safely many times before in collecting urine from children and adults.

<u>Collecting the sample:</u>

- On waking in the morning, do not save the first urine that is passed.
- Begin saving the sample with the <u>next</u> urine that is passed.
- Save all urine that is passed throughout the day into the large container.
- Any urine that is passed at bedtime and night-time should be saved too.
- On waking the next morning, save the first urine that is passed that day. The collection is now complete.
- The Nutritionist will visit you and your child again on the day that the urine collection is completed. She will ask if your child has taken the PABA tablets. She will also ask your child if any urine was missed out from the collection, and how many times this might have happened. She will then take the sample and equipment away.

- Children who provide a sample will be given a gift voucher as a thank you for their help.

The Good Food Study

If you have any questions, please telephone:
Mrs Sam Revill or Miss Julie Hooper (0191 222 8719)

7.2.1 Collection and assay of 24-hr urine samples

At the time of first interview or first home visit, each child was asked to consider providing a urine sample on the weekend day of the 3 day food diary. Favourable replies were followed up with a further home or school visit to provide further information and obtain parental consent. Each child was seen again at home on the day prior to the collection. A full and detailed explanation of the collection procedure was given and the following administered:

A small packet containing 3 PABA tablets (3 x 80mg p-aminobenzoic acid)
A large sealable 2L collection container
A smaller, portable 1L container for use away from home
A colourful storage bag

Figure 7-2 Parental consent form (24-hour urine sample)

Human Nutrition Research Centre
Wellcome Laboratories
Royal Victoria Infirmary
Queen Victoria Road
Newcastle upon Tyne
Tel: 0191 222 8719

The Good Food Study

Consent Form

Please read this consent form carefully and sign if you to agree to your child providing a 24-hour sample of urine as part of the 'Good Food Study' conducted by the Human Nutrition Research Centre of the University of Newcastle

This is to confirm that:
I have read the letter entitled 'Providing a 24-hour sample of urine'
I have read and understood the Information Sheet provided
I understand that all information given will be CONFIDENTIAL
I understand that my child may withdraw from providing a urine sample at any time with giving a reason
I agree to my child providing a 24-hour sample of urine

Signed...

Your full name (please print)...

This form will be collected by..

Thank you

All samples were retrieved the day immediately following collection to ensure correct handling and storage and to prevent contamination and/or deterioration of the sample. Each subject was asked to recall the number of PABA tablets taken and to comment on the completeness of the collection. Missed micturition and number of PABA tablets were recorded for each individual. Subjects were also asked if any medication (including pain 0relief tablets and vitamin preparations) had been taken on the day of collection since this was known to be source of aromatic amino acids which would effect the quantification of PABA.

7.2.2 Urine sample preparation

On arrival into the laboratory all samples were placed into a refrigerator at 1°C. After checking an adequate seal the storage containers were gently inverted and shaken. The contents of the container were measured using volumetric glassware and the total volume of sample recorded. Two 20ml aliquots of each sample were removed and placed into sterile sample holders to be frozen at –20°C until required.

7.2.3 Assay

Experimental methods and materials for the determination of urinary nitrogen, creatinine, sodium and potassium and the determination of p-aminobenzoic acid are presented in the Appendix (see 12.12 to 12.15).

7.2.4 Anthropometric measurements

The height and weight of all subjects measured in order to calculate BMR (see 5.2.2). The mean daily energy intake (MJ/day) of each subject was used to then calculate the ratio of energy intake to BMR which is expressed as a physical activity level or PAL. For further details of this method see Section 5.2.4.

7.2.5 Data processing and analysis

Resultant data were entered onto SPSS v.10 to determine statistical descriptives of PAL, 24-hour urinary nitrogen and creatinine excretion and 24-hour urinary potassium and sodium excretion. In addition, a comparison between the dietary intakes of macronutrients by children meeting the recommended PAL and those not meeting the PAL were undertaken in order to attempt to identify those macronutrients consumed in significantly lower amounts. Differences between groups between children meeting the PAL in the intervention and control group were investigated using t-test and differences within groups determined using paired t-test. The relationship between urinary biochemical variables and dietary intake were investigated using Pearson's correlation or Spearman's correlation analysis as appropriate to the data. Urinary nitrogen excretion of each subject providing a urine sample was correlated to the intake of dietary nitrogen as protein (g/day) on the day of urine collection using

Spearman's correlation (SPSS (v.10) for Windows). Urinary creatinine data were correlated with total dietary protein intake (g/day) on the day of 24hr collection using Spearman's correlation (SPSS (v.10) for Windows). Excretion coefficients of the urinary analytes were compared to reference data for values for healthy children of a similar age.

7.3 Results

7.3.1 Ratio of mean energy intake to basal metabolic rate

The mean (SD) PAL of children in the intervention and control group at baseline are shown in Table 5.1 in Chapter 5. Mean PAL of children at post-intervention are displayed in Table 5.2 and mean changes in PAL between phases T0 and T1 are displayed in Table 5.3 . Similar data of the PAL of both boys and girls in the two groups are presented in Chapter 5. The number of children taking part in the study who did not meet the recommended PAL at baseline and post-intervention are shown in Table 7.1. At baseline, 66% of girls in the intervention group and 65% in the control did not meet the recommended PAL of 1.48. The figures are slightly lower at post-intervention; 59% (intervention) and 52% (control). For both groups at phase T0 and T1, this is more than half of the total number of girls.

Table 7.1 Number and sex of children in the intervention group and the control group who did not meet the recommended physical activity level (PAL) at baseline and intervention

	Number of children	
	Intervention ($n = 84$)	Control ($n = 83$)
Baseline (T0)		
All	51	47
Boys	16	13
Girls	35	34
Post-intervention (T1)		
All	46	40
Boys	15	13
Girls	31	27

Fewer boys in both groups did not meet the recommended PAL of 1.56 at phase T0 and T1. 51% of boys in the intervention group and 42% in the control group did not meet the PAL of 1.52. These percentages fell slightly at phase T1 to 48% of the intervention group and 42% of the control. The number of boys not meeting the PAL were lower than the number of girls in both groups at both phases.

The mean (SD) of intake of macronutrients in children in both groups who met the recommended physical activity level (Department of Health, 1991) at baseline and the intake of macronutrients of those children who did not are presented in Table 7.2 . The mean energy intakes of PAL Groups A and B are significantly different as one would expect. T-test of differences between macronutrient intake show that in PAL Group B, several nutrients were consumed in significantly lower amounts in both the intervention and control group. These macronutrients were sugar, fat, saturated fat and fibre. In the control group children only, PAL Group B also had significantly lower intakes of starch. A non-significant tendency towards lower intakes of total carbohydrate can also be observed in those children not meeting the recommended PAL in both the intervention and control group.

Table 7.2 Mean (SD) of intake of macronutrients in children in the intervention and control group who met the recommended physical activity level (PAL Group A) and those who did not meet the recommended physical activity level (PAL Group B) at baseline (T0)

Nutrient	Mean (SD) of intake of macronutrients					
	Intervention			Control		
	PAL Group A$^{\propto}$	PAL Group B$^{\Psi}$	P value*	PAL Group A$^{\propto}$	PAL Group B$^{\Psi}$	P value*
Energy (MJ/day)	10.5 (1.8)	7.5 (1.1)	0.000	10.4 (1.4)	7.2 (1.4)	0.000
Protein (g/day)	75.4 (15.9)	69.6 (11.1)	0.679	71.7 (15.8)	53.8 (15.6)	0.102
Total carbohydrate (g/day)	328.8 (51.6)	250.5 (34.4)	0.080	334.8 (50.7)	233.8 (49.6)	0.053
Starch (g/day)	176.3 (40.7)	137.7 (24.3)	0.573	170.9 (28.0)	130.5 (26.6)	0.000
Total sugar (g/day)	150.7 (34.9)	98.6 (21.3)	0.000	161.2 (42.3)	101.1 (36.5)	0.000
Total fat (g/day)	104.3 (24.9)	73.0 (15.3)	0.000	101.2 (16.5)	67.7 (15.7)	0.000
Saturated fat (g/day)	36.2 (9.7)	24.2 (5.9)	0.000	34.1 (7.9)	22.5 (5.6)	0.001
NSP (g/day)	9.7 (2.1)	12.5 (3.1)	0.000	9.7 (3.1)	11.8 (2.3)	0.000

$\propto$ Children with a PAL ratio value equal to or greater than 1.48 (girls) and 1.56 (boys)
Ψ Children with a PAL ratio value less than 1.48 (girls) and 1.56 (boys)
* t-test of differences between PAL group A and PAL group B

Macronutrient intakes at phase T1 are shown in Table 7.3.

The data presented in Table 7.3 show a similar pattern of intake of macronutrients by children not meeting the recommended physical activity level in that these children were consuming significantly less total sugar, total fat and fibre per day.

Table 7.3 Mean (SD) of intake of macronutrients in children in the intervention and control group who met the recommended physical activity level (PAL Group A) and those who did not meet the recommended physical activity level (PAL Group B) at baseline post-intervention (T1)

Nutrient	Mean (SD) of intake of macronutrients					
	Intervention			Control		
	PAL Group A[∝]	PAL Group B[Ψ]	P value*	PAL Group A[∝]	PAL Group B[Ψ]	P value*
Energy (MJ/day)	11.0 (1.9)	7.9 (1.8)	0.000	10.7 (1.9)	7.8 (1.5)	0.000
Protein (g/day)	81.3 (21.9)	80.8 (15.3)	0.648	82.1 (17.5)	76.7 (16.5)	0.781
Total carbohydrate (g/day)	340.1 (63.1)	327.7 (55.7)	0.111	333.4 (57.7)	252.9 (51.4)	0.072
Starch (g/day)	196.7 (42.4)	149.1 (36.6)	0.092	192.6 (37.4)	148.5 (32.5)	0.042
Total sugar (g/day)	141.5 (36.4)	94.3 (29.0)	0.000	135.7 (34.0)	102.5 (31.4)	0.000
Total fat (g/day)	111.6 (22.3)	76.8 (21.8)	0.000	108.6 (23.4)	73.1 (17.7)	0.000
Saturated fat (g/day)	30.8 (10.9)	31.8 (10.7)	0.661	30.8 (10.3)	28.9 (9.3)	0.402
NSP (g/day)	11.0 (3.8)	13.9 (3.9)	0.002	11.9 (3.6)	13.5 (3.6)	0.006

∝ Children with a PAL ratio value equal to or greater than 1.48 (girls) and 1.56 (boys)
Ψ Children with a PAL ratio value less than 1.48 (girls) and 1.56 (boys)
* t-test of differences between PAL group A and PAL group B

However, at phase T1, there were no significant differences between intake of total carbohydrate between the two PAL groups and a significant tendency towards lower intakes of starch in PAL Group B children in the control group only.

7.3.2 Urinary biochemical markers: nitrogen and creatinine and PABA check for completeness of 24hr sample

A total of 43 children provided a 24-hr urine sample (16 boys and 27 girls). However, four of the girls who provided a 24-hr sample were among those subjects who declined to be weighed when anthropometric measurements were taken. As a result of this four 24-hr samples were excluded from the final analysis.

A primary statistical analysis of the results of the 24-hr samples showed the urinary nitrogen and creatinine data were not normally distributed and hence non-parametric statistical methods were used in the subsequent analysis of the urinary analytes. Urinary sodium and potassium excretion data were found to be normally distributed. The median (IQ range) of the urinary analytes nitrogen and creatinine are presented in Table 7.4 along with data providing evidence of the completeness of the 24-hr collection (expressed as a % of the total amount of p-aminobenzoic acid (mg) taken on the day of collection).

Table 7.4 24-hour urinary excretion of nitrogen and creatinine and recovery of p-aminobenzoic acid in 24-hour urine samples of 38 children for validation of dietary food diaries

Urinary analyte	Median (IQ range) of urinary variable Boys (n=16)	Girls (n=22)	All (n=38)
Total volume of 24hr urine (ml)	722 (495-1131)	725 (417-1081)	722 (420-1081)
Recovery of PABA (%)	52 (9-90)	69 (28-85)	58 (12-85)
Urinary nitrogen excretion (g/day)	6.7 (4.6-8.2)	5.7 (4.5-6.9)	5.9 (4.7-7.6)
Urinary nitrogen excretion coefficient (mg/kg/24hr)	143 (83-195)	117 (86-152)	123 (87-162)
Ratio of urinary nitrogen: dietary nitrogen	0.72 (0.52-0.89)	0.67 (0.49-0.91)	0.72 (0.49-0.90)
Urinary creatinine excretion coefficient (mg/kg/24hr)	16.8 (13.4-18.1)	15.4 (11.6-21.0)	16.9(11.8-19.8)

The data presented in show the median volume of the 24-hr collections to be 725ml/24hr (interquartile range 420ml to 1081ml). The median volume of collection for girls was 725ml/24 hr and boys 722ml/24 hr. The data show that the median amount of PABA recovered from the 24-hr urine collections was 58% (interquartile range 12% to 85%). The number of samples where the recovery rate for PABA was greater than 85% was nine. The determination of urinary nitrogen excretion/24hr in all samples showed the median value to be 5.9g of urinary nitrogen per 24hr (5.7g/24hr in girls and 6.7g/24hr in boys). The median value for excretion of urinary nitrogen expressed as the excretion coefficient was 123mg/kg/24hr (117mg/kg/24hr in girls and 143mg/kg/24hr in boys).

The data resulting from dividing the amount of urinary nitrogen (g) excreted in 24hr (multiplied by a factor of x 6.25) by the amount of dietary protein nitrogen consumed on the day of the 24hr collection show the median value to 0.72 (median 72% of dietary protein) for all subjects and 0.67 in the 24hr samples provided by girls and 0.72 in the 24hr samples provided by boys. Urinary nitrogen excretion (g/day) did not show a significant correlation to dietary protein consumed on the day of 24hr collection (r= 0.230, P=0.138).

Urinary creatinine excretion coefficient (expressed as mg/kg/24hr) data show that the median value was determined to 16.9mg/kg/24hr (15.4mg/kg/24hr in girls and 16.8mg/kg/24hr in boys. Reference data for urinary creatinine excretion in healthy children are shown in Table 7.6.

Table 7.5 Urinary creatinine reference values and their source: mean urinary creatinine excretion in healthy children

Author	Age of subjects	Boys (mg/kg/24hr)	Girls (mg/kg/24hr)	Boys (mg/day)	Girls (mg/day)
Ritchey *et al*, 1973	13-15	-	17.6	-	-
Ritchey *et al*, 1973	11-12	-	20.6	-	-
De Santo 1992	9-11	29.3	34.3	1061.6	1181.5
De Santo 1992	12-14	31.1	32.4	1568.5	1528.2
Sweid 1997	11-12	20.0	18.0	-	-
Sweid 1997	13-15	13.9	13.8	-	-
Neubert & Remer, 1998	9-13	22.3	21.3	-	-

7.3.3 Urinary sodium and potassium

Mean (SD) of urinary sodium and potassium excretion (g/day) are displayed Table 7.6. The mean excretion of urinary sodium (g/day) was approximately double that of urinary potassium excretion (g/day). This is further demonstrated in the mean values for the ratio of urinary sodium to urinary potassium. The mean urinary sodium:potassium value for all children was 1.93 (with a ratio of 1.91 for boys and 2.01 for girls).

Table 7.6 Mean (SD) urinary sodium and potassium excretion of 38 children providing a 24-hour urine sample

		Mean (SD)	
Urinary analyte	**Boys (n=16)**	**Girls (n=22)**	**All (n=38)**
Urinary sodium excretion (g/day)	4.6 (2.1)	4.2 (2.2)	4.4 (2.1)
Urinary potassium excretion (g/day)	2.8 (1.6)	2.2 (1.2)	2.4 (1.3)
Urinary sodium:potassium ratio	1.91 (0.8)	2.01 (0.4)	1.93 (0.6)

Table 7.7 Mean (SD) ratio of urinary sodium:potassium excretion of 38 children providing a 24-hour urine sample

	Mean urinary Na:K	Median (IQ range) intake of fruits and vegetables (g/day)*	Correlation Ψ of Na:K to fruit and vegetable intake	P value
Boys (*n*=16)	1.91 (0.8)	83.2 (113)	-.518	0.048
Girls (*n*=22)	2.01 (0.4)	78.0 (130.0)	-.515	0.010
All (*n*=38)	1.93 (0.6)	82.0 (120.1)	-.491	0.001

* Fruit and vegetable intake (g/day) on day of 24hr collection

Ψ Spearman's rank correlation

Urinary sodium excretion in the children did not correlate with the total fruit and vegetable intake of children on the day of 24hr collection (r= -.052 P=0.754). However, urinary potassium excretion (g/day) was shown to correlate significantly to the fruit and vegetable intake of the children on the day of 24hr urine collection; $r = 0.372$, $P=0.020$. The relationship between urinary potassium excretion (g/24hr) and total fruit and vegetable intake on the day of 24hr collection was investigated using Spearman's rank correlation and is displayed in Figure 7-3 .The relationship between the total fruit and vegetable intake of the children providing a sample and corresponding ratio of urinary sodium excretion to urinary potassium excretion is shown in Figure 7-4 .

Figure 7-3 Relationship between urinary potassium excretion (g/24hr) and total fruit and vegetable intake (g/24hr) on day of 24hr urine collection in 38 children

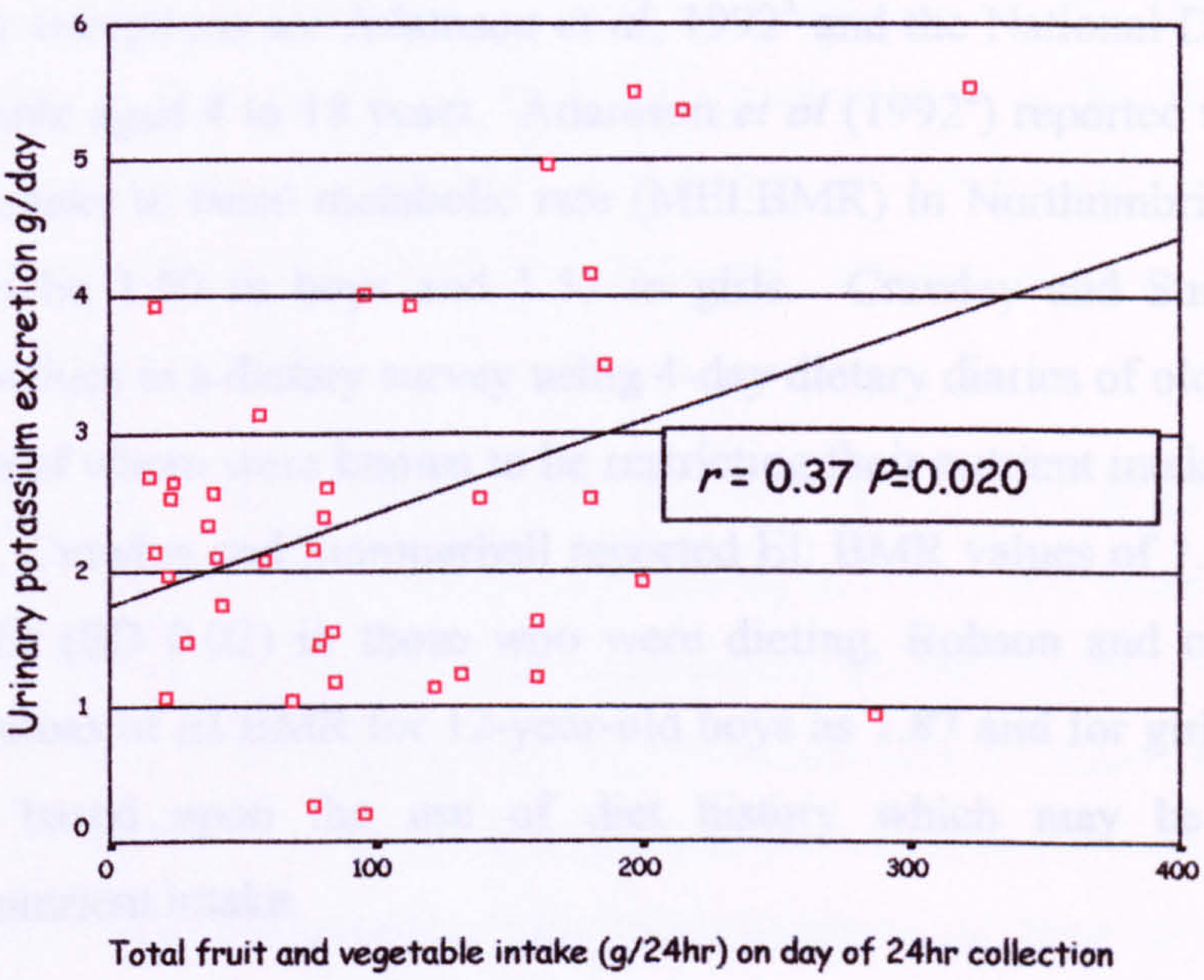
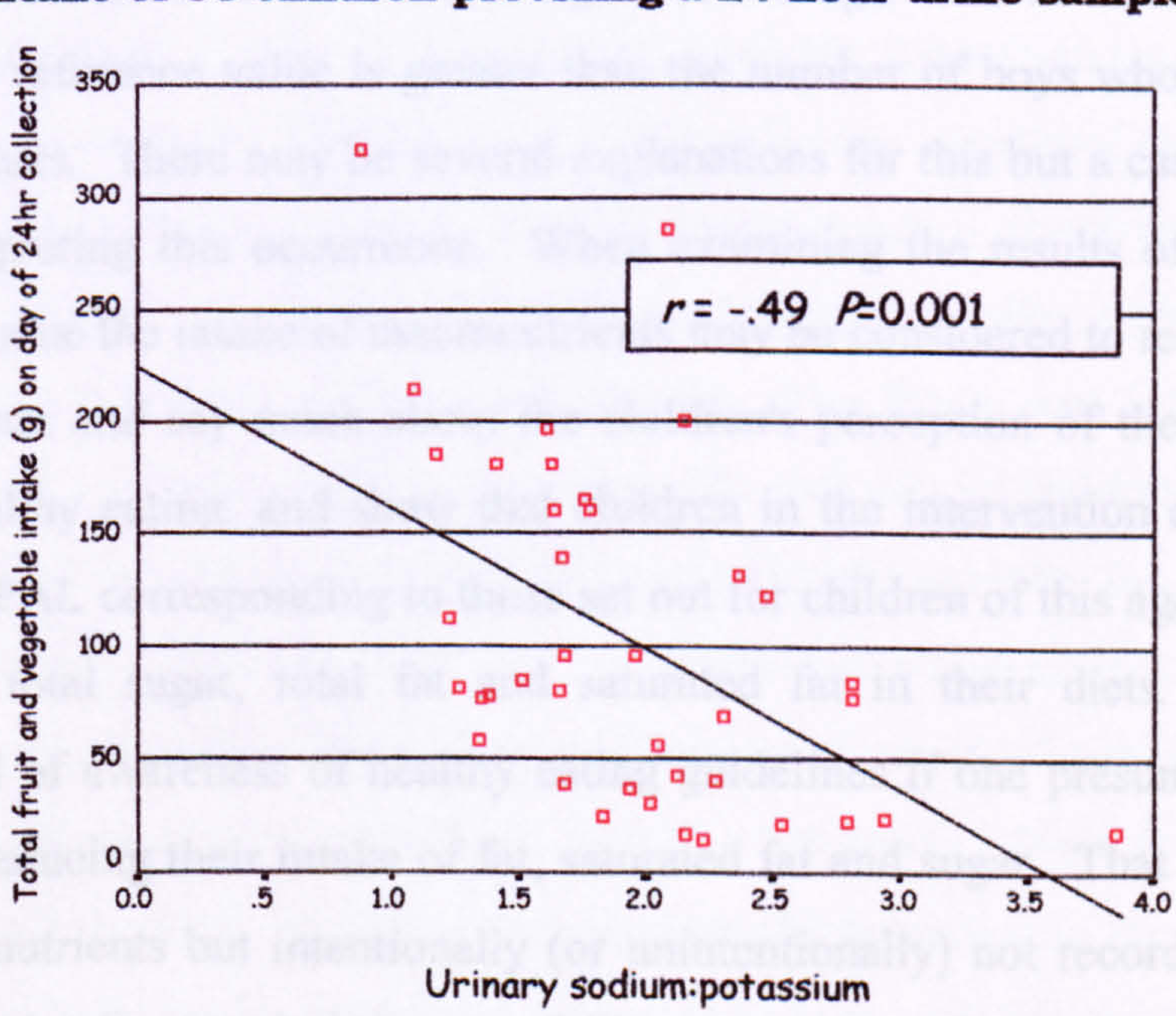


Figure 7-4 Relationship between urinary sodium:potassium and fruit and vegetable intake of 38 children providing a 24-hour urine sample



7.4 Discussion

The mean PAL values of children in both groups at baseline and post-intervention were determined to be 1.5 (SD 0.4) (see Table 5.1 and Table 5.2, Anthropometry Chapter 5). On this group level PAL values are comparable to those recommended by the Department of Health (1991) for children of this age-group. There is a lack of published studies that have employed food diaries as the method of dietary assessment coupled with anthropometric measurements. The challenge here then is to making intelligent judgements about the PAL values of children participating in this study when there is little to data to which it may be compared. Notable exceptions are Adamson *et al*, 1992[a] and the National Diet and Nutrition Survey: young people aged 4 to 18 years. Adamson *et al* (1992[a]) reported the mean ratio of measured energy intake to basal metabolic rate (MEI:BMR) in Northumbrian children aged 11-12-years old to be 1.50 in boys and 1.57 in girls. Crawley and Summerbell (1998) reported EI:BMR values in a dietary survey using 4-day dietary diaries of older boys aged 16-17-years-old, some of whom were known to be restricting their nutrient intake for the purpose of loosing weight. Crawley and Summerbell reported EI: BMR values of 1.77 in non-dieters (SD 0.02) and 1.11 (SD 0.02) in those who were dieting. Robson and colleagues (2000) reported median values of EI:BMR for 12-year-old boys as 1.87 and for girls, 1.72, however these values are based upon the use of diet history which may be predisposed to overestimation of nutrient intake.

The data show that mean PAL values for girls in the intervention and control group are slightly below the reference value of 1.48 for girls of this age. The numbers of girls who did not meet the PAL reference value is greater than the number of boys who did not meet the PAL reference values. There may be several explanations for this but a cautious approach is necessary in interpreting this occurrence. When examining the results of further grouping children by PAL value the intake of macronutrients may be considered to reveal an awareness of dietary guidelines and say much about the children's perception of their diet and of the appearance of healthy eating. and show that children in the intervention and control group who did not have PAL corresponding to those set out for children of this age were consuming significantly less total sugar, total fat and saturated fat in their diets. This suggest a sophisticated level of awareness of healthy eating guidelines if one presumes these children are intentionally reducing their intake of fat, saturated fat and sugar. That the children were consuming these nutrients but intentionally (or unintentionally) not recording them in their food diaries cannot be dismissed - it is a possibility.

One key point to recognise here is that children in PAL Group B were found to be consuming lower amounts of total fat, saturated fat and sugar, in both the control and intervention. There are several possible explanations for this. The children are aware of healthy eating guidelines and are choosing to consume less of these nutrients. Possibly the children are consuming these nutrients but have chosen to reduce their quantity at some stage during the recording period (either when completing food diaries or during the interview to ascertain portion sizes. A 'Hawthorne' effect may have manifested itself in the recording dietary intake - children were more aware of their daily diet because they were actually having to write down all the foods and drinks that they consumed. There may have been an intention to 'please' researchers by recording foods and beverages they understood to be 'healthy' which resulted in lower values for total fat, saturated fat and sugar. A further explanation is that the recording period coincided with a period of intentional reduction in these nutrients, perhaps with the intention to loose weight.

There is evidence to show that intakes of total fat, saturated fat and sugar are significantly lower in children in PAL Group B - those not meeting the reference values in both groups. There is evidence of a non-significant tendency towards slightly lower intakes of starch in both groups when intakes of protein and total carbohydrate were not found to be significantly different. The lower intakes of total fat, saturated fat and sugar in both the intervention and control group suggest that the children became more aware of their diet simply through recording their intake and modified their intake of foods. This is further supported by the evidence provided at phase T1, when a lower number of children were found to have PAL below that recommended. Only total sugar and total fat were found to be consumed in significantly lower amounts by children in PAL Group B - the novelty of completing the food diaries had worn thin and children were possibly less concerned about the foods they were consuming and/or recording. Of the 198 children recruited into the study at phase T0, 43 children volunteered to provide a 24hr urine sample. This figure was less the target of 50 children as a 25% sub-sample of the study group. The majority of children were reluctant to provide a sample and voiced several concerns regarding the sample, for example, that the collection itself was too difficult, they were embarrassed about collecting a sample and perceived that it present obstacles to pursuing their usual range of activities at weekends. Several parents reported that they would not be happy for their children to provide a sample because they thought it would be unhygienic to store the container in the house or because there were small children in the household who may tamper with the sample if they had the opportunity to do so. A small number of parents voiced reservations about allowing their child to take PABA tablets during the collection period. Of the total number of 24-hr collections, five had to be disregarded because the subjects had declined to be weighed during the collection of anthropometric measurements. The complete range of urinary volume observed was between 200ml/24hr to 1600ml/day. This range of output is to be expected as output will be affected by several factors, for example, total consumption of water on the day of collection, the time of year of at collection and the amount of physical activity undertaken by the children on the day of collection.

The results of the analysis of p-aminobenzoic acid recovery show that the percentage of recovery was low (median recovery rate was 59% of the amount of PABA consumed). Reference to the literature suggests that in order for 24hr urine samples to be considered complete, a PABA recovery rate of less than 85% will indicate that the sample is probably incomplete (Bingham & Cummings, 1983). Nine samples of a total of 38 were shown to be probably complete. This in itself confers a degree of unreliability to the collections and any quantitative analysis performed on urinary analytes thereafter. It is possible to apply a weighting factor to account for the deficit in PABA recovery to the determination of other urinary analytes but this was not deemed to be appropriate in this study because of the poor PABA recovery rate. In addition, 15 children completing 24hr samples reported not taking all the PABA tablets because they had forgotten or had left them at home when they wanted to go out and 7 children reported missed micturitions on the day of collection. In view of these occurrences it would seem that children of this age find it difficult to collect their urine for a twenty-four hour period. In a clinical setting it may be possible to supervise children providing samples adequately. In free-living subjects this is not possible to such an extent. The success of the collections may be greater if researchers telephone the children at home or visit the children and their parents at home during the day of collection to enquire about any problems encountered and to offer help and encouragement. In view of the incompleteness of collection of the majority of urine samples the validity of the quantitative determination of other urinary analytes is questionable. Gregory *et al* (2000) reported in the NDNS survey that 24-hr collections were not attempted in children aged 4-18-years-old as the pilot work carried out for the survey of people aged 65 years and over showed that subject compliance in collecting urine samples was poor, at less than 50% and that this technique of validation would not be suitable for including in the mainstage survey. The survey of 4-18-year-olds used only a 'spot' collection of urine for the indirect estimation of sodium intake of individuals participating in the study.

Urinary nitrogen excretion values were found not to correlate significantly with dietary protein intake on the day of dietary diary. This is likely due to low urinary nitrogen excretion values but again reflects the incompleteness of the urine samples. However, the mean ratio of urinary nitrogen to dietary protein was determined to be 0.72 (72%) which is a reasonable figure in view of the percentage recovery of PABA (mean 58%). It may also be contributed to growth in the children (as demonstrated in the anthropometric data in Chapter 5). Together these values imply that the children were at least successful in collecting about two-thirds of their total urine volume on the day of collection and this suggests that with adequate supervision a complete collection may be achievable in children of this for use in validation procedures in future studies. Reference values displayed in Table 7.6 show that the mean urinary creatinine coefficient value for all subjects providing a sample is slightly lower than would be expected in the complete 24hr samples of children of this age and again reflects the deficit of the sample. It is for this reason that urinary creatinine excretion is no longer viewed as a valid method for checking for completeness of twenty-four collection (despite low intra-individual variation) (Bingham & Cummings, 1985, Narayanan and Appleton, 1980).

The use of harmless derivatives such as p-aminobenzoic acid employed as an additional biochemical analyte , independent of those of diet and fluid intake, which does not require collections in duplicate or triplicate to be made, is more reliable and attractive. The mean creatinine coefficient of boys was 16.8mg/kg/24hr and is comparable to the values determined by Sweid (1997) for boys aged 13-years-old; 13.9-20.0 mg/kg/24hr and those of Neubert and Remmer, 1998; 22.3mg/kg/24hr in boys aged 9-13-years old. The mean creatinine coefficient of the girls participating in this study compare favourably to those published by Ritchey *et al*, 1973 who reported creatinine coefficient values of 17.6mg/kg/24hr for girls aged 13-15-years-old and 20.0mg/kg/24hr for girls aged 11-12-years-old. The creatinine coefficient of girls in this study was shown to be lower than boys as would be expected in children of this age - girls nearing or already having entered puberty and boys retaining a greater percentage of lean body mass - the mean creatinine coefficient of girls was 15.4mg/kg/24hr and compares to the values of Sweid, 1997; 13.0 - 18.0 mg/kg/24hr for girls aged 11-15-years old respectively. Although these values are reasonably comparable to reference values, nonetheless urinary creatinine excretion did not correlate with significance to the amount of dietary protein consumed on the day of 24hr-urine collection. Mean urinary sodium excretion values in boys was 4.6 g/24hr and in girls 4.2g/24hr (with a mean of 4.4g/24hr for all subjects and was not found to correlate with the fruit and vegetable intake of the children. Mean urinary potassium excretion in boys was 2.8g/24hr and in girls 2.2g/24hr (with a mean of 2.4g/day for all children) and the relationship between urinary potassium excretion and intake of fruit and vegetables was shown to be positive - the relationship was small but significant at r=0.37, P=0.020. These results imply that urinary sodium excretion was twice that of urinary potassium excretion in the children and that as fruit and vegetable intake increased in the children this was coupled by an increase in potassium excretion. In order to assume that urinary sodium excretion was twice that of potassium, and that urinary sodium excretion in the children is related to dietary intake of sodium an assumption is made that the children were in balance for both. Such an assumption would be unwise on the basis of one day of urine collection and the collection would need to be repeated over 3 to 7 days (preferably in a clinical setting) to give an accurate picture of potassium and sodium excretion. Similar data on urinary sodium: urinary potassium were reported in the NDNS by Gregory *et al*(2000). Gregory *et al* reported a mean urinary sodium: urinary potassium ration in boys aged 11-14-years-old to be 4.1 and in girls to be 4.3, these data compare favourably with the results of the analysis of 24hr urines in this study.

In summary, the physical activity level of the children on the group level was satisfactory. The numbers of girls not meeting a PAL of 1.48 was greater than the number of boys not meeting the PAL of 1.56. Girls were more concerned about having their weight measured which suggests low self-esteem with body image and body size which may impact upon dietary intake or the reporting of dietary intake. A Hawthorne effect could likely explain the lower intakes of selected micronutrients as this occurred at both baseline and intervention but decreased during the post-intervention recording period. Children with a PAL lower than the reference values of the Department of Health (1991) were reporting significantly lower intakes of total fat, saturated fat and total sugar and in the control group only there was a tendency towards lower intakes of starch, all of which may imply some sophisticated knowledge of the energy value of such nutrients or a self-restriction of these nutrients in the children's diets.

Figure 8-1 Frequency of consuming sugary and acidic foods and beverages, as recorded in food diary (girl, control school at post-intervention)

Day Friday

Start each day on a new sheet

Time of Day	Food & Drink Include: Brand name, flavour and packet weight	Cooking method e.g. fried, grilled	Amount Eaten e.g. cup, slice, tsp, bowl, portion of family meal	Bought from home, shop school
7.30am	1 lemon Locket	—	—	Shop
7.55am	1 Glass of water	—	—	home
9.15am	1 Cherry Tune	—	—	Shop
9.25am	1 cherry tune	—	—	shop
9.45am	2 Jolly Ranchers Sweets	—	—	shop
10.20am	1 cherry tune		—	Shop
11.00am	1 Space Raider Crisps	— Corn	—	Shop
11.05am	1 Salt vinegar crisps	—	—	Shop
11.15am	1 salt & vinegar crisps	—	—	shop
11.40am	Strawberry Calipso Pop	—	—	School
12.55am	1 Cup of Pepsi	—	1 cup	School
1.10pm	1 portion chips	fried	1 portion	School
1.45pm	1 Flap Jack	Large piece smaller	—	School
4.05pm	1 Cup of Dandilion & Burdock	—	1 cup	home
7.10pm	1 Carton of ribena	Large	1 carton	Shop
10.10pm	1 Pkt of M & M's	—	1 Packet	Shop

8.1 Introduction

Evidence to support the relationship between dietary sugars and caries development is well documented. Dental caries are caused by acid produced as a result of fermentation of carbohydrates, predominantly dietary sugar, by plaque bacteria. The literature presents often conflicting views on this relationship in terms of dental and public health nutrition and the views may differ between the dental and dietetic professions and those of the sugar and food manufacturing industry. The public health concerns regarding dietary sugars relate to the intake of total sugars, non-milk extrinsic sugars, the frequency of consumption and their percentage contribution to total dietary energy.

The impact of sugar intake upon primary and secondary dentition is a cause for concern to dental health professionals. The main area of interest is that of non-milk extrinsic sugars: those sugars defined as 'sugars not contained within the cell walls or naturally intrinsic in foods, sugars not coming from milk or milk products'. The Department of Health (Department of Health, 1989) COMA report on Dietary Sugars and Human Disease finds no evidence to suggest that either intrinsic sugars nor milk sugar have an adverse effect upon health. Foods containing starch are recognised to have a minimal impact upon the development of dental caries, except where extrinsic sugars have been added to a cooked starchy food (Rugg-Gunn & Nunn, 1999).

Sugars intake in children has become a public health concern as dietary sugars are known to impact upon dental health, particularly sugar in the form of non-milk extrinsic sugar. Gregory and colleagues reported on the total sugars intake of children aged 4-14-years-old and revealed that the average daily total sugars intake (g) of children aged 11-14-years-old was 122g/day in boys and 99g/day in girls. Non-milk extrinsic sugar intakes were reported to be 90g/day in boys and 73g/day in girls. Earlier, Hackett *et al* (1984) reported values of 124g/day of total sugars in boys aged 11-14-years-old and 116g/day in girls of the same age. Adamson *et al* (1992[a]) reported sugars intake in Northumbrian schoolchildren aged 11-12-years-old to be 118g/day, providing approximately 22% of daily energy. Rugg-Gunn *et al* (1993[a]) reported total sugars consumption in 379 children aged 11-12-years-old to be 118g/day and non-milk extrinsic sugar consumption to be an average of 90g/day, contributing to 17% of dietary energy. Typically, non-milk extrinsic sugars in the diets of children contribute to approximately 60-70% of total dietary sugar intake (Department of Health, 1991).

Hackett *et al* (1984) reported that overall intakes of sugars varied considerably and the range of intakes was wide (range 30g/day to 210g/day). Hackett and colleagues also refer to the peak intake times for dietary sugars, which were reported to be between 07.00-09.00; 12.00-13.00; 16.00-18.00; 20.00-22.00hrs, which were observed to correlate with meal patterns, suggesting that most sugary foods were consumed as part of a meal. Almost twenty years on, it is reasonable to suggest that even the eating patterns of children of this age (just starting a secondary school) will have changed somewhat and that the prevalence of 'grazing' amongst older children and teenagers may likely impact upon the frequency of eating sugars, either as part of a meal or as a snack.

The Department of Health report on Dietary Sugars and Human Disease (Department of Health, 1989) recommended that the intake of foods rich in non-milk extrinsic sugars should be decreased and be replaced by fruit, vegetables and starchy foods. In 1991 the Department of Health report on dietary reference values further recommended that non-milk extrinsic sugar intake should not exceed 60g per day in the adult diet and should contribute no more than 11% in groups not consuming alcohol.

Dietary habits are known to form during childhood and habits acquired in childhood have the potential to impact upon the predisposition to diet-related diseases such as obesity, coronary heart diseases, osteoporosis, diabetes and some cancers in adult life. Dietary factors may impact upon dental health either pre-eruptively (during the formation of teeth) and post-eruptively (due a local effect within the mouth). Non-milk extrinsic sugars are known to impact upon the primary and secondary dentition of children due a local intra-oral interaction. Frequency of intake of sugary foods and beverages is important. This is because of the length of time required for 'oral clearance' of sugars in the mouth. At least 30 minutes following ingestion of sugary foods is required for saliva pH to return to within normal range. The bathing effect of saliva is most important in the remineralisation of the tooth enamel and in the combat of acid-producing bacteria naturally present within the mouth.

Dental erosion is a progressive and irreversible wearing away of hard dental tissue as a result of a chemical progress due to the action of acids upon hard surfaces. The dominant cause of dental erosion is acids, either extrinsic or intrinsic. The source of acids may be dietary (extrinsic acids) or those naturally produced by the body, for example, gastric juices (intrinsic). Intrinsic acids that may come into contact with dental tissue as a result of regurgitation. Extrinsic acids are acids present in foods, such as fruit acids and ascorbic acids found in fruit juices and fruit and sports drinks, in addition to phosphoric acid commonly found in carbonated beverages (Rugg-Gunn, 1993[b]). Dental erosion is becoming more prevalent, the rate of dental erosion is increasing and is a major concern in children and teenagers (Sheilham, 2001).

As with dietary sugars, frequency of intake is known to be an important factor in the aetiology of erosion as well as quantity consumed. Al-Dlaigan *et al* (2000) report significant correlation of erosion on buccal and lingual surfaces of teeth in 14-year-old Birmingham teenagers to the dietary data obtained by self-completed questionnaire. The authors report a range of significance values for several beverages in conjunction with their frequency of consumption Those beverages raising the most concern were apple juice, cola drinks, other carbonated drinks, tea, spirits and sports drinks. All were reported to be significantly correlated to dental erosion at $P < 0.001$ (using Spearman's correlation).

Duff (1999) reports on a market research programme carried out on behalf of Tetra Pak UK Ltd with 506 school children and it is evident that industry funding has influenced the content and perspective and probably the hidden agent of what is essentially a poor paper but worthy of review entirely because of this. Whilst commenting on the increasing independence of choice of older children and teenagers, Duff also refers to the power of advertising and the effect of peer group influences and how this group of the population 'represent a major area of potential for expansion' - presumably expansion of nutritionally pointless and potentially harmful soft drinks. Duff comments that soft drinks are consumed in public by teenagers for the image they perceivably portray in addition to personal preferences regarding taste. Most children aged 11-14-years-old purchase most of their soft drinks from school and from corner shops and newsagents and fewer soft drinks are consumed within the family home.

The consumption of carbonated soft drinks by children and teenagers is becoming an increasing concern, particularly in the Northern counties of England and in Scotland and in low-income families. Walker *et al* (2000) reported that young people in the Northern Region and Scotland were more likely to report frequent consumption of non-diet carbonated soft drinks and that young people whose parents were in receipt of benefits were more likely to report that they consumed non-diet carbonated soft drinks more than once a day. In the age range of 11-14-years-old this was found to be statistically significant ($P<0.05$). Walker *et al* also reported that non-diet carbonated soft drinks were also the largest contributor by weight to the total weight of sugary foods and beverages consumed by children participating in the NDNS.

In their study of dietary patterns in inner city adolescents, Watt & Sheilham (1996) reported that 19% of adolescents were consuming a non-diet carbonated soft drink at least once a day and 16% were consuming these beverages more than once a day. Later, Inchley *et al* (2001) reported that a greater percentage of children from less affluent families were consuming non-diet carbonated soft drinks (82%) than those from more affluent families (56%). Also, the relationship between daily consumption and family affluence was negatively associated and as family affluence decreased, the percentage of children consuming a non-diet *carbonated* drink each day increased significantly.

In summary, diet and nutrition have the potential to affect the structure and appearance of teeth, to predispose to dental caries and to contribute to the erosion of tooth enamel. The relationship between dietary sugars (and non-milk extrinsic sugars) has been clearly established although evidence to support a relationship between cooked starches and cooked starches with added sugars is emerging. There is no evidence to suggest that sugars naturally present in foods, for example those within the cellular structure of fruits, have a significant role in the aetiology of dental caries. Whilst the prevalence of dental caries among children and teenagers has been decreasing since the 1970's the rate of reduction is now slowing down. The prevalence and severity of dental caries in children and adolescents remains a public dental health problem and, although dental erosion is not currently a public dental health problem it is emerging as a concern.

Current advice regarding a sensible dietary approach to reducing the prevalence and severity of dental caries and to promoting oral health focuses specifically to a reduction in the consumption of non-milk extrinsic sugars. This should be accompanied by a reduction in the number of times a day that foods containing non-milk extrinsic sugars, to four times or less. The advice to restrict the consumption of sugar-rich foods to mealtimes may not be appropriate to individual's not following a structured meal pattern and may be meaningless to adolescents who are recognised to have a fondness of 'grazing' (Moynihan, 2000[b]). A diet that is sub-optimal in terms of micronutrient intake may also predispose to dental caries and dental disease. The low acidity and mineral content of drinks of milk and water make these preferable beverages for children and teenagers. A more purposeful approach to dietary advice may be to avoid negative messages about certain foods and attend to positive information about which foods may be consumed (Rugg-Gunn, 1993[b]). Foods with a high non-milk extrinsic sugar content, such as carbonated soft drinks, fruit drinks, confectionery, biscuits, cakes should not be promoted specifically as 'bad' foods but should be replaced where possible with a greater consumption of vegetables, fruits, and starchy foods whilst preferable beverages are milk or water.

8.1.1 Aims

The specific aims of these analyses were to:

- **To report on the intake and foods that contribute to the intake of non-milk extrinsic sugars in the diets of 167 children aged 11-13-years-old from deprived social backgrounds prior to and following a school-based controlled dietary intervention**
- **To report on the intake and frequency of intake of selected sugary foods and beverages**
- **To report on the intake and the frequency of acidic foods in the diets of the children**
- **To report on the types of drinks selected at bedtime**

8.2 Methods

8.2.1 Collection of dietary data

Quantitative and qualitative dietary data were collected from each subject using a dietary diary as reported in Chapter 6.

8.2.2 Isolation of specific food codes and quantification of dietary variables

The dietary data entered onto the Microsoft Access Database were examined using database reports to access and view the range and frequency of food codes used. For the identification and isolation of food codes for foods and beverages containing non-milk extrinsic sugar, reference was made to the non-milk extrinsic sugar content of foods commonly consumed by the children during the six day recording period (Table 8.1). Non-milk extrinsic sugar values were calculated using the method of the Human Nutrition Research Centre of the University of Newcastle for determining non-milk extrinsic sugars in food. For the identification and isolation of food codes for acidic beverages reference was made to the National Diet and Nutrition Survey 2000: young people aged 4 to 18 years, Volume 2: Report of oral health survey (Gregory *et al*, 2000) (Table 8.2).

Table 8.1 Foods contributing to the non-milk extrinsic sugars intake in 167 children

Carbonated drinks (non-diet)	Ice lollies
Fruit drink concentrate, made up (not low-sugar)	Processed fruit puree, pie fillings
Ready to drink fruit juice drinks (not low-sugar)	Sweet spreads (i.e. chocolate)
Pure fruit juice	Desserts (jellies, mousses etc)
Sweet biscuits	Sweetened breakfast cereals
Cakes (sponge etc)	Puddings
Ice cream (not low-sugar)	Sweetened yoghurts and fromage frais
Milk puddings and custards	Baked beans (not reduced sugar)
Baked goods (doughnuts, pastries)	Marmalade and jam
Table sugar	Sugar and chocolate confectionery

Table 8.2 Acidic foods and beverages observed in the dietary diaries of 167 children

All carbonated soft drinks (diet and non-diet)	Pure fruit juices
All fruit drink concentrates (diet and non-diet)	Fresh and tinned fruit (excluding bananas)

A detailed hand search of all food codes relating to the selected foods and beverages was performed on the electronic food tables accessed by the study database and either individual codes or food group codes were identified. Subsequently, database queries were written to isolate all the codes by each individual subject at baseline and at post-intervention (see Figure 8.2. and 8.3)Separate files were compiled for foods and beverages containing non-milk extrinsic sugars and for acidic foods and beverages. Beverages consumed at bedtime were compiled by referring to the bedtime recorded by children in dietary diaries at baseline and post-intervention or in the absence of this record, by querying beverages consumed after 22.30 hours and combining queries and records obtained. Nine types of beverages were commonly consumed by the children at bedtime and these beverages were used to assign a number value to food codes to simply the procedures (the value 0 was assigned where a beverage was consumed at bedtime).

Figure 8-2 Examples of purpose-written database queries for the isolation and quantification of foods and beverages containing non-milk extrinsic sugar and acidic foods and beverages

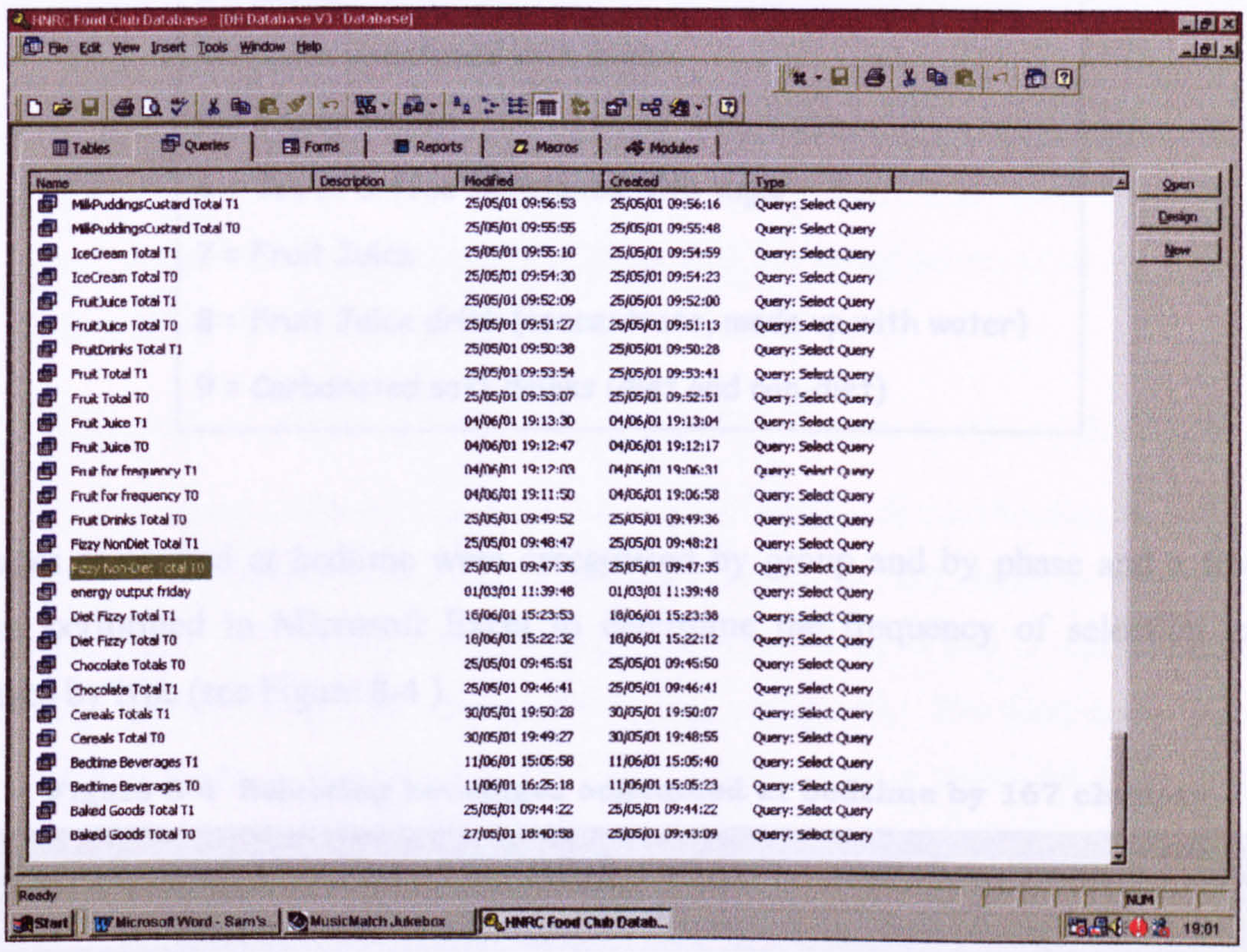
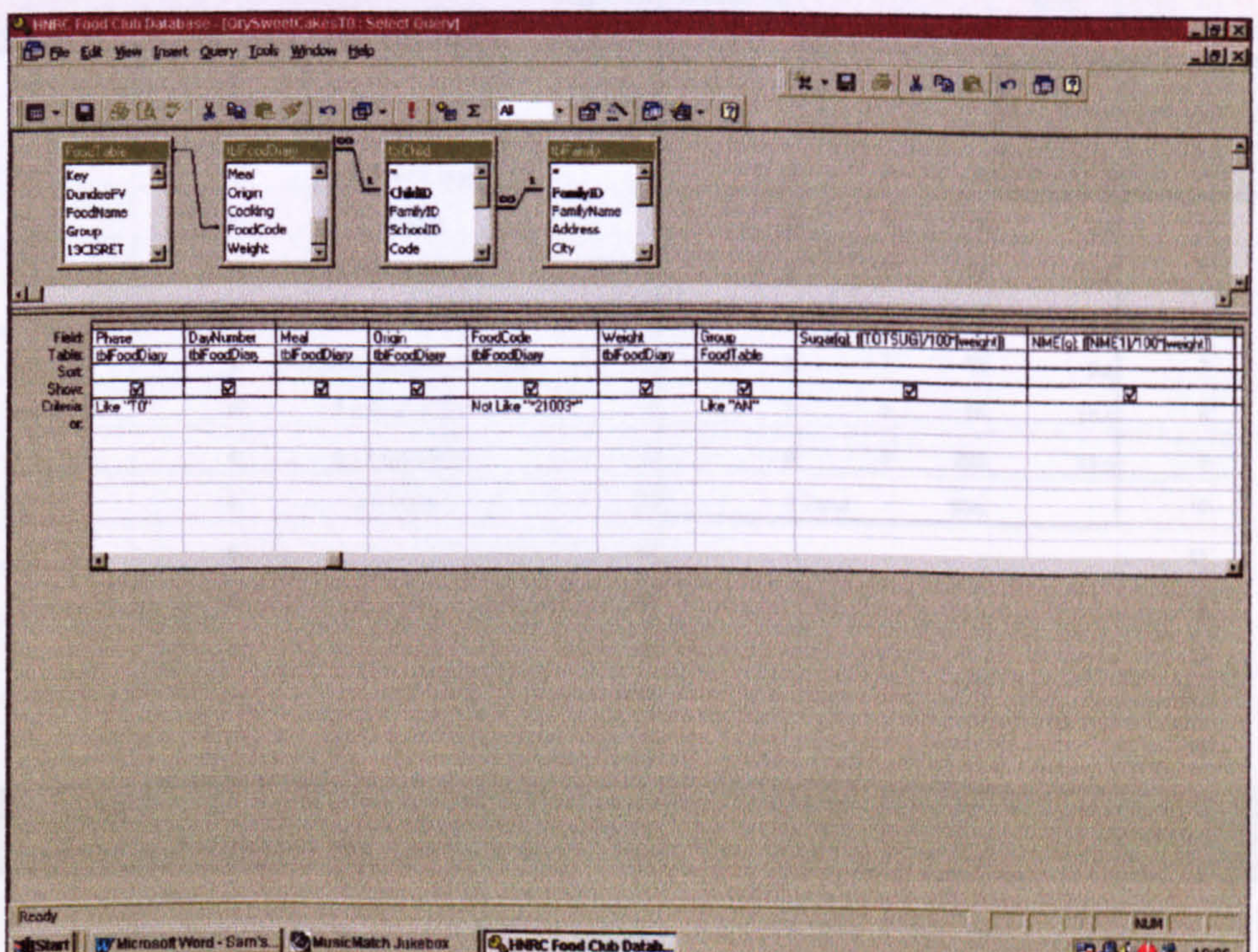


Figure 8-3 Example of a purpose-written database query for sweet biscuits (to calculate the contribution of non-milk extrinsic sugar)



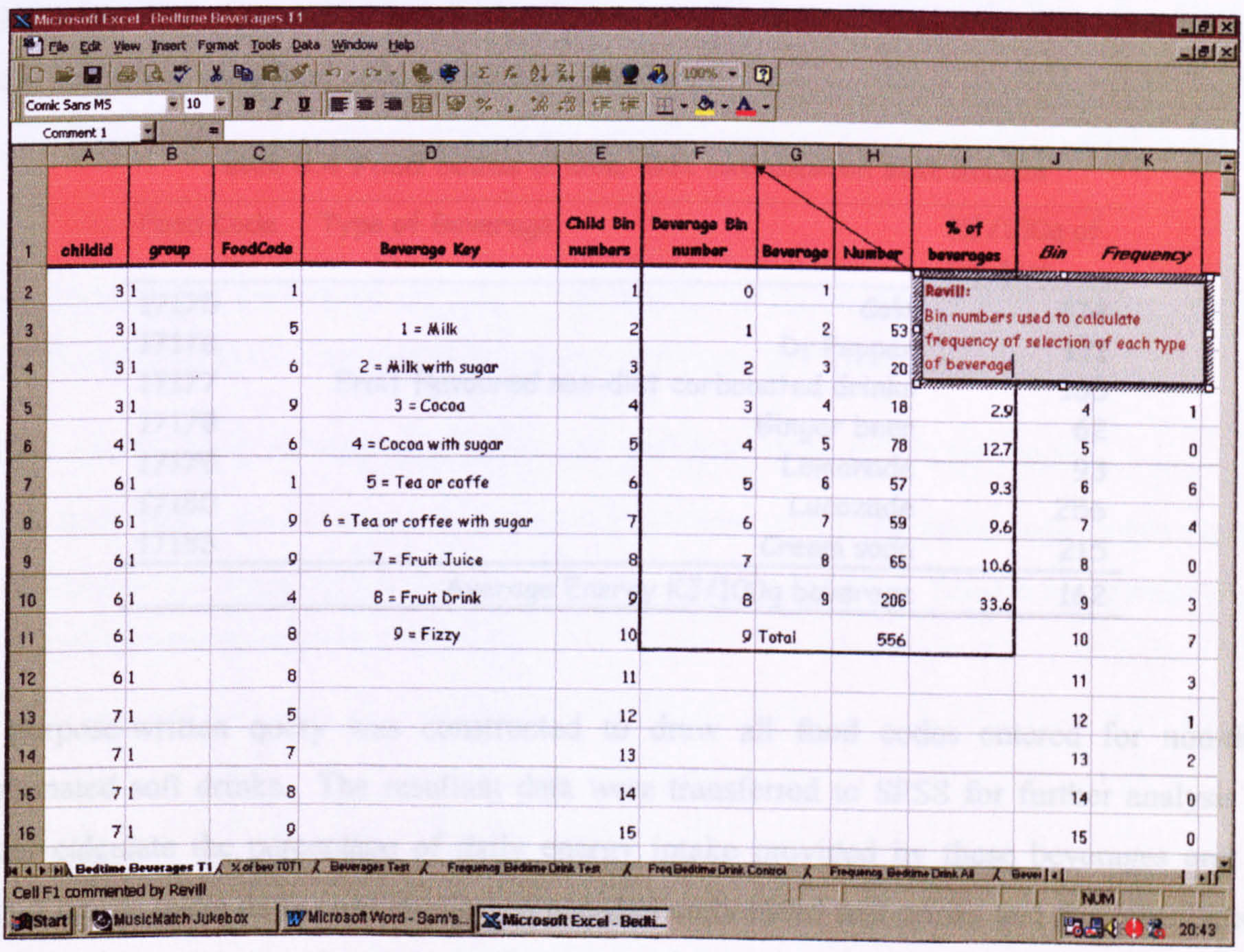
NB: Here the code '21003' is excluded as it is for a cheese-flavoured biscuit

Table 8.3 Range of bedtime beverages recorded by children in dietary diaries

1 = Milk
2 = Milk sweetened with sugar
3 = Cocoa
4 = Cocoa sweetened with sugar
5 = Tea or coffee
6 = Tea or coffee sweetened with sugar
7 = Fruit Juice
8 = Fruit Juice drink (concentrate, made up with water)
9 = Carbonated soft drinks (diet and non-diet)

Beverages consumed at bedtime were categorised by group and by phase and a frequency analysis performed in Microsoft Excel to determine the frequency of selection of these beverages by type (see Figure 8-4).

Figure 8-4 Selecting beverages consumed at bedtime by 167 children



	A	B	C	D	E	F	G	H	I	J	K
1	childid	group	FoodCode	Beverage Key	Child Bin numbers	Beverage Bin number	Beverage	Number	% of beverages	Bin	Frequency
2	3	1	1		1	0	1				
3	3	1	5	1 = Milk	2	1	2	53			
4	3	1	6	2 = Milk with sugar	3	2	3	20			
5	3	1	9	3 = Cocoa	4	3	4	18	2.9	4	1
6	4	1	6	4 = Cocoa with sugar	5	4	5	78	12.7	5	0
7	6	1	1	5 = Tea or coffe	6	5	6	57	9.3	6	6
8	6	1	9	6 = Tea or coffee with sugar	7	6	7	59	9.6	7	4
9	6	1	9	7 = Fruit Juice	8	7	8	65	10.6	8	0
10	6	1	4	8 = Fruit Drink	9	8	9	206	33.6	9	3
11	6	1	8	9 = Fizzy	10	9	Total	556		10	7
12	6	1	8		11					11	3
13	7	1	5		12					12	1
14	7	1	7		13					13	2
15	7	1	8		14					14	0
16	7	1	9		15					15	0

All queries were then transported onto a Microsoft Excel spreadsheet in order to perform mathematical summations and averages or by filtration for each food code or group on a subject by subject basis at baseline and at post-intervention.. Data were later transferred to SPSS for analysis to estimate mean daily intake of sugary foods and beverages and of acidic foods and beverages at baseline and following intervention. Differences between intervention and control group in these dietary variables at baseline and following intervention were determined using t-test. Within group changes following intervention were determined using paired t-test. Secondary analyses by sex were carried out using paired t-test for within group changes and differences between groups determined using t-test.

8.2.3 Contribution of Non-diet Carbonated Soft Drinks to Mean Energy Intake

Following the primary analysis of sugars intake and of the foods contributing to the intake of total sugars and non-milk extrinsic sugars, non-diet carbonated soft drinks were recognised as a major contributor to total sugars intake in the children. Due to this, a separate analysis of the consumption of non-diet carbonated drinks was performed. The food codes relevant to these beverages were isolated (Table 8.4) and a mean energy value for 100g of product calculated. This mean corresponds closely to that of cola (code 17175) which was the fifth most frequently-used food code in the study database.

Table 8.4 Food codes of non-diet carbonated soft drinks

Food Code	Type of Beverage	KJ/100g of Product
17175	Cola	174
17176	Dr Pepper	171
17177	Fruit flavoured non-diet carbonated drinks	165
17178	Ginger beer	62
17179	Lemonade	93
17180	Lucozade	256
17183	Cream soda	215
	Average Energy KJ/100g beverage	162

A purpose-written query was constructed to draw all food codes entered for non-diet carbonated soft drinks. The resultant data were transferred to SPSS for further analysis in order calculate the percentage of daily energy intake provided by these beverages and to report on the mean daily consumption of non-diet carbonated soft drinks and the contribution of these beverages to the mean daily energy intake of the children at baseline, post-intervention and the changes between the two phases.

All queries were then transported onto a Microsoft Excel spreadsheet in order to perform mathematical summations and averages or by filtration for each food code or group on a subject by subject basis at baseline and at post-intervention.. Data were later transferred to SPSS for analysis to estimate mean daily intake of sugary foods and beverages and of acidic foods and beverages at baseline and following intervention. Differences between intervention and control group in these dietary variables at baseline and following intervention were determined using t-test. Within group changes following intervention were determined using paired t-test. Secondary analyses by sex were carried out using paired t-test for within group changes and differences between groups determined using t-test.

8.2.3 Contribution of Non-diet Carbonated Soft Drinks to Mean Energy Intake

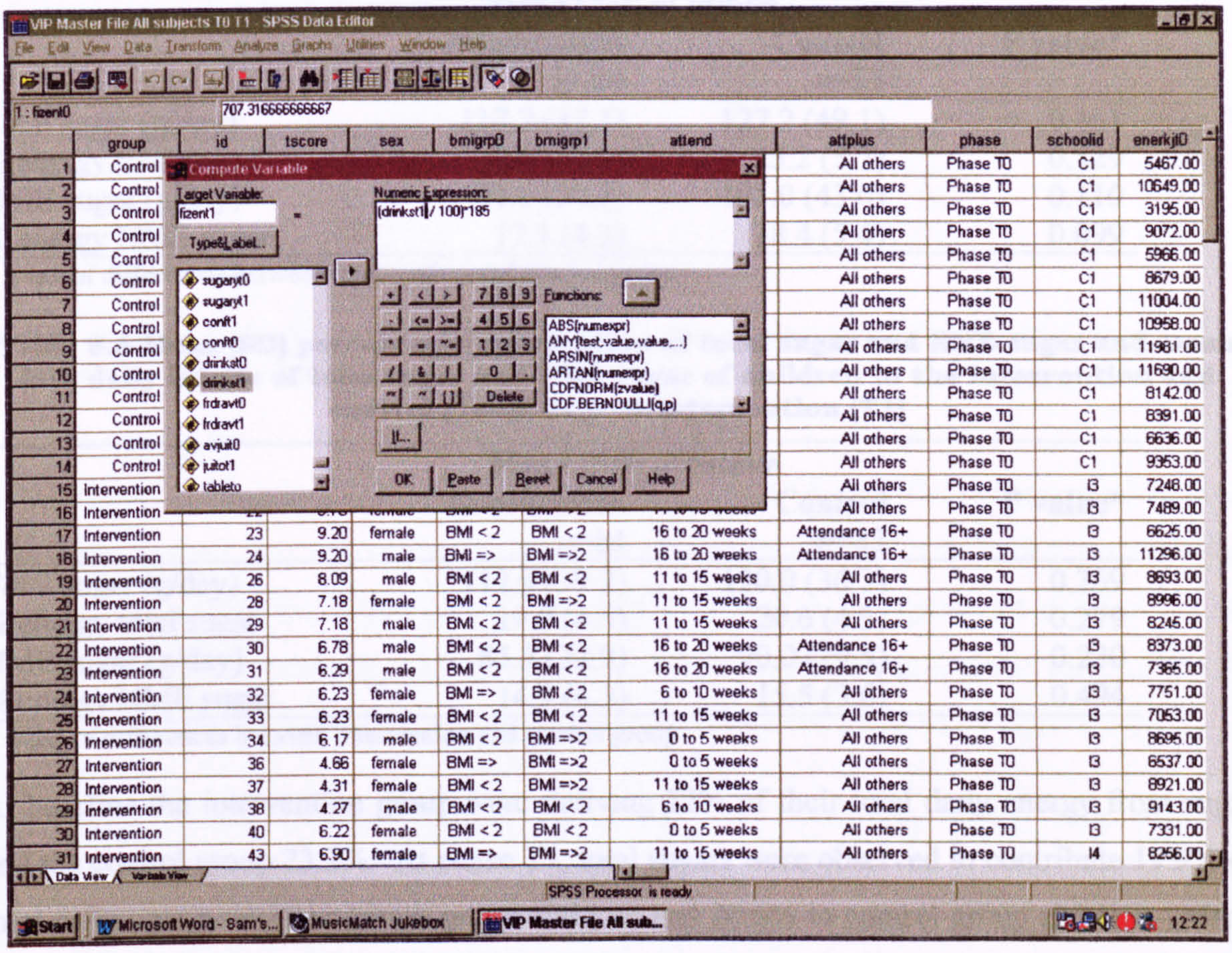
Following the primary analysis of sugars intake and of the foods contributing to the intake of total sugars and non-milk extrinsic sugars, non-diet carbonated soft drinks were recognised as a major contributor to total sugars intake in the children. Due to this, a separate analysis of the consumption of non-diet carbonated drinks was performed. The food codes relevant to these beverages were isolated (Table 8.4) and a mean energy value for 100g of product calculated. This mean corresponds closely to that of cola (code 17175) which was the fifth most frequently-used food code in the study database.

Table 8.4 Food codes of non-diet carbonated soft drinks

Food Code	Type of Beverage	KJ/100g of Product
17175	Cola	174
17176	Dr Pepper	171
17177	Fruit flavoured non-diet carbonated drinks	165
17178	Ginger beer	62
17179	Lemonade	93
17180	Lucozade	256
17183	Cream soda	215
	Average Energy KJ/100g beverage	162

A purpose-written query was constructed to draw all food codes entered for non-diet carbonated soft drinks. The resultant data were transferred to SPSS for further analysis in order calculate the percentage of daily energy intake provided by these beverages and to report on the mean daily consumption of non-diet carbonated soft drinks and the contribution of these beverages to the mean daily energy intake of the children at baseline, post-intervention and the changes between the two phases.

Figure 8-5 Calculation of the contribution of non-diet carbonated soft drinks



8.3 Results

The analyses was performed on 167 children (see 3.3.3), 84 intervention children and 83 control, completing all food diaries at baseline and post-intervention.

8.3.1 Mean daily intake of total sugar and non-milk extrinsic sugar

Mean daily intake of total sugars and non-milk extrinsic sugars and percentage dietary energy provided by total sugars and non-milk extrinsic sugars are shown in Table 8.5 and mean daily intake at post-intervention in Table 8.6.

Table 8.5 Mean (SD) percentage contribution of total sugar and NME sugar and mean (SD) daily intake of total sugar and NME sugar of children who attended in the intervention and control group at baseline (T0)

	Mean (SD) of intake		
	Intervention *n*=84	Control *n*=83	P value*
Total sugar (g/day)	117.7 (37.1)	127.2 (49.1)	0.161
% energy total sugar	22.0 (4.6)	23.2 (5.7)	0.129
NME sugar (g/day)	91.6 (31.6)	101.0 (43.0)	0.110
% energy NME sugar	17.1 (4.3)	18.4 (5.4)	0.099

* t-test of differences between intervention and control group

Table 8.6 Mean (SD) percentage contribution of total sugar and NME sugar and mean (SD) daily intake of total sugar and NME sugar of children in the intervention and control group) at post-intervention (T1)

	Mean (SD) of intake		
	Intervention *n*=84	Control *n*=83	P value*
Total sugar (g/day)	112.9 (39.2)	120.0 (36.3)	0.369
% energy total sugar	19.9 (4.5)	20.6 (4.3)	0.279
NME sugar (g/day)	85.7 (32.9)	90.0 (29.5)	0.230
% energy NME sugar	14.9 (4.3)	15.5 (3.6)	0.494

* t-test of differences between intervention and control group

At baseline the intervention group were deriving 22% of their total daily energy from sugar and the control group 23.2%. At phase T1, total sugars were observed to contribute 19.9% of total daily energy in intervention group children and 20.6% in control group children. Mean total sugar intake in the intervention group children at baseline was estimated to be 117.7g/day and 127.2g/day in control group children. At post-intervention children in the intervention group were observed to consume a mean 112.9g/day total sugars and the control group 120.0g/day.

Non-milk extrinsic sugar contributed 17.1% of total daily energy intake in the intervention group children at baseline and contributed 18.4% in the control group at this phase. These values are seen to fall at the post-intervention phase to 14.9% in the intervention group and to 15.5% in the control group. There were no significant differences observed between the intervention group and control in intake of total sugar and non-milk extrinsic sugar at either baseline or post-intervention. Table 8.7 shows the mean (SE) of change in intake of total sugar and non-milk extrinsic sugar and the percentage of total daily energy the children derived from total sugar and non-milk extrinsic between the two phases.

Table 8.7 Mean (SE) of the change in percentage contribution of total sugar and NME sugar and mean (SE) of the change in daily intake of total sugar and NME sugar of children in the intervention and control group between baseline and post-intervention (T1-TO)

	Mean (SE) of changes in intake (T1-T0)					
	Intervention n=84	P value**	Control n=83	P value**	C v I $^{\Psi}$	P value*
Total sugar (g/day)	-4.8 (4.4)	0.284	-7.2 (5.1)	0.164	2.3	0.409
% energy total sugar	-2.2 (0.5)	0.000	-2.6 (0.6)	0.000	0.2	0.524
NME sugar (g/day)	-5.9 (4.1)	0.152	-10.1 (4.5)	0.018	4.8	0.721
% energy NME sugar	-2.0 (0.6)	0.001	-2.9 (0.6)	0.000	0.8	0.823

* t-test of differences in changes between intervention and control group
** t-test of changes within groups
Ψ mean difference of the differences in changes in control and intervention group (control value minus intervention value of change)

Both groups are seen to significantly decrease the amount of total daily energy derived from total sugar in their diets whilst the slight decrease in intake of total sugar (g/day) was not seen to be significant within either group. At post-intervention, a significant decrease in the amount of non-milk extrinsic sugar (g/day) was observed in the control group only, where the small decrease in the diets of the intervention children was not found to be significant.

Both groups were observed to derive significantly less total daily energy from non-milk extrinsic sugars between baseline and post-intervention, although the amount itself is small. There were no significant differences, however, in changes in intake of non-milk extrinsic sugar (g/day) or the contribution of non-milk extrinsic sugar to total daily energy intake between the intervention and control group.

The intake of total sugar and of non-milk extrinsic sugar by sex at baseline are displayed in Table 8.8 along with the percentage contribution to total daily energy of boys and girls in the intervention and control group.

There were no significant differences in the intake of total and non-milk extrinsic sugar for either boys or girls in the two groups at baseline. The contribution of total sugar and non-milk extrinsic sugar to the total daily energy intake of boys and of girls in the intervention and control group are shown in Table 8.9.

Table 8.8 Mean (SD) of intake of total sugar and NME sugar and contribution of sugar to daily energy of boys and girls who attended in the intervention and control group at baseline (T0)

		Mean (SD) of intake Intervention n=84	Control n=83	P value*
Total sugar (g/day)	Boys	133 (40)	144 (49)	0.218
	Girls	108 (31.7)	117 (46.4)	0.341
% energy total sugar	Boys	21 (4.0)	23 (6.3)	0.362
	Girls	22 (4.9)	23 (5.4)	0.287
NME sugar (g/day)	Boys	103 (35)	113 (42)	0.190
	Girls	85 (27.5)	94 (42)	0.218
% energy NME sugar	Boys	16 (4.2)	18 (5.6)	0.294
	Girls	17 (4.3)	18 (5.3)	0.297

* t-test of differences between intervention and control group

As at baseline, there were no significant differences in the intake of either total sugar or non-milk extrinsic sugar between boys and between girls in the two groups and no significant differences observed in the contribution to total daily energy (see Table 8.9).

Table 8.9 Mean (SD) of intake of total sugar and NME sugar and contribution of sugar to daily energy of boys and girls who attended in the intervention and control group at post-intervention (T1)

		Mean (SD) of intake Intervention n=84	Control n=83	P value*
Total sugar (g/day)	Boys	128 (39.4)	139 (36.6)	0.313
	Girls	104 (36.3)	109 (31.6)	0.435
% energy total sugar	Boys	19 (4.8)	21 (4.1)	0.349
	Girls	20 (4.4)	21 (4.4)	0.527
NME sugar (g/day)	Boys	94 (33)	103 (30.8)	0.263
	Girls	81 (32)	82 (26)	0.807
% energy NME sugar	Boys	14 (4.4)	15 (3.8)	0.319
	Girls	16 (4.2)	16 (3.6)	0.939

* t-test of differences between intervention and control group

Several of the within group changes occurring in the intake of total and non-milk extrinsic sugar by boys and by girls were observed for both sexes between baseline and post-intervention (see Table 8.10). Boys in both groups and girls in both groups were observed to derive less energy from total sugars intake between the two phases and this change was found to be significant within groups. A non-significant tendency towards a decrease in the amount of non-milk extrinsic sugar was observed in girls of the control group only, however, both boys and girls in both groups were seen to derive significantly less total daily energy from non-milk extrinsic sugar. At T1, the changes observed in the children's diets in their intake of total sugar and non-milk extrinsic sugar were not found to statistically significant between the two groups.

Table 8.10 Mean (SE) of changes in intake of total sugar and NME sugar and contribution of sugar to daily energy of boys and girls who attended in the intervention and control group between baseline and post-intervention (T1-T0)

		Mean (SE) of change in intake					
		Intervention n=84	P value**	Control n=83	P value**	C v I[Ψ]	P value*
Total sugar (g/day)	Boys	-5.0 (7.1)	0.485	-5.7 (7.8)	0.142	1.1	0.655
	Girls	-4.6 (5.7)	0.434	-8.1 (6.7)	0.238	2.8	0.707
% energy total sugar	Boys	-2.0 (0.9)	0.048	-2.6 (0.8)	0.006	0.4	0.640
	Girls	-2.2 (0.7)	0.004	-2.6 (0.8)	0.003	0.5	0.393
NME sugar (g/day)	Boys	-8.8 (6.4)	0.181	-10.1 (6.6)	0.474	1.3	0.949
	Girls	-4.1 (5.2)	0.421	-11.4 (6.0)	0.066	0.5	0.696
% energy NME sugar	Boys	-2.2 (0.03)	0.036	-2.7 (0.8)	0.002	8.2	0.893
	Girls	-2.0 (0.7)	0.015	-2.9 (0.8)	0.001	2.8	0.369

* t-test of differences between intervention and control group
* t-test of differences within groups
Ψ mean difference of the differences in changes in control and intervention group (control value minus intervention value of change)

8.3.2 Intake of sugary foods and beverages

Table 8.11 Mean intake (g/day) of sugary foods and beverages of children in the intervention and control group at baseline (T0)

	Mean (SD) of intake		
	Intervention (n=84)	Control (n=83)	P value*
Confectionery ± (g/day)	38.1 (21.9)	37.9 (23.6)	0.969
All soft drinks, non low-calorie↗	436.2 (187.5)	488.3 (260.7)	0.182
Fruit Juice (g/day)	44.1 (74.6)	84.4 (120.5)	0.024
Selected sugary foods[Ψ] (g/day)	699.2 (288.8)	760.3 (320.0)	0.020

± Sugar and chocolate confectionery
↗ Includes all carbonated soft drinks and diluted fruit drinks
Ψ Includes biscuits, cakes, pastries, sweetened breakfast cereal, milk; sponge and other puddings, ice cream, sweetened yoghurts and dairy desserts, preserves and sweet spreads, fruit pie filling and fruit in syrup, table sugar, fruit juice and soft-drinks (non-low calorie)
* t-test of differences between intervention and control group

Table 8.11 shows the mean total intake of confectionery, soft drinks and fruit juice and the mean daily total intake of these foods by both groups at baseline (T0). The children's intake of confectionery (both sugar and chocolate confectionery) and of all non-diet type soft drinks are seen to be similar between the two groups. Children in the control groups were observed to be consuming a significantly higher amount of pure fruit juice than children in the intervention group but a significantly higher total amount of sugary foods at baseline also. Children in the intervention group were consuming a mean total of 699g/day of sugar foods and children in the control group 760g/day. The children's total daily intake of sugary foods at post-intervention are displayed below in Table 8.12. Children in the intervention were seen to be consuming a greater amount of sugar and chocolate confectionery at phase T1 and the difference in confectionery consumption between the two groups was significant (P=0.034). As at baseline, children in the control were consuming a higher amount of fruit juice each day than children in the intervention group (P=0.003) at phase T1. Similar also to that observed at baseline, children in the control group were consuming a significantly higher total daily amount of sugary foods than children in the intervention group (P=0.040).

Table 8.12 Mean intake (g/day) of sugary foods and beverages of children in the intervention and control group at post-intervention (T1)

	Mean (SD) of intake		
	Intervention (n=84)	Control (n=83)	P value*
Confectionery ± (g/day)	36.8 (27.9)	28.7 (21.2)	0.034
All soft drinks, non low-calorie ☧	402.6 (201.8)	436.4 (213.5)	0.294
Fruit Juice (g/day)	39.4 (75.0)	75.0 (117.0)	0.003
Selected sugary foods Ψ (g/day)	588.1 (250.0)	669.6 (257.8)	0.040

± Sugar and chocolate confectionery
☧ Includes all carbonated soft drinks and diluted fruit drinks
Ψ Includes biscuits, cakes, pastries, sweetened breakfast cereal, milk; sponge and other puddings, ice
Ψ cream, sweetened yoghurts and dairy desserts, preserves and sweet spreads, fruit pie filling and fruit in syrup, table sugar, fruit juice and soft-drinks (non-low calorie)
* t-test of differences between intervention and control group

Data displayed in Table 8.13 depicts a tendency in all children towards a reduced total consumption of all types of sugary foods and beverages and this is further demonstrated in the children's reduction of percentage of dietary energy derived from total sugars and non-milk extrinsic sugars (see 8.3.1). This decrease in the consumption of sugary foods and beverages was significant within both groups but there was not a significant difference between the two groups in this reduction. A slight decrease in the amount of sugar and chocolate confectionery was observed in the control group only and this was significant at P=0.005.

Table 8.13 Mean (SE) of change in daily intake of sugary foods and beverages in children in the intervention and control group between baseline and post-intervention (T1-T0)

	Mean (SE) of change in intake T1-T0				
	Intervention (*n*=84)	P value**	Control (*n*=83)	P value**	P value*
Confectionery ± (g/day)	-1.3 (3.7)	0.746	-9.3 (3.2)	0.005	0.105
All soft drinks, non low-calorie↗	-33.6 (29.4)	0.257	-46.9 (33.4)	0.165	0.766
Fruit Juice (g/day)	-9.4 (10.8)	0.665	-4.7 (17.3)	0.589	0.819
Selected sugary foods Ψ (g/day)	-71.2 (31.0)	0.005	-90.7 (37.9)	0.019	0.691

± Sugar and chocolate confectionery

↗ Includes all carbonated soft drinks and diluted fruit drinks

Ψ Includes biscuits, cakes, pastries, sweetened breakfast cereal, milk; sponge and other puddings, ice cream, sweetened yoghurts and dairy desserts, preserves and sweet spreads, fruit pie filling and fruit in syrup, table sugar, fruit juice and soft-drinks (non-low calorie)

* t-test of differences between intervention and control group

** t-test of differences within groups

8.3.3 Contribution of foods and food groups to non-milk extrinsic sugar intake

The contribution of foods and food groups to the intake of non-milk extrinsic sugar by the children at baseline is shown in Table 8.14 .

Table 8.14 Mean (SD percentage contribution of foods and food groups to non-milk extrinsic sugar intake in children in the intervention and control group at baseline (T0)

Food Type	Mean (SD) percentage contribution to total NME sugar intake		
	Intervention (*n*=84)	Control (*n*=84)	P value*
Non-diet carbonated drinks	26.4 (15.1)	25.4 (14.8)	0.686
Fruit Drinks [a]	9.4 (9.8)	11.0 (6.7)	0.317
Confectionery	24.0 (13.0)	21.4 (13.5)	0.214
Cakes, biscuits & baked goods	7.7 (6.8)	10.1 (7.8)	0.056
Breakfast cereals	5.6 (3.2)	5.0 (2.9)	0.589
Pure fruit juice	3.6 (1.6)	7.0 (2.5)	0.017
Table sugar	4.2 (2.2)	3.7 (1.7)	0.219
Ice cream	2.9 (1.5)	2.4 (2.0)	0.366
Puddings	2.6 (1.8)	2.1 (1.3)	0.508
Preserves and sweet spreads	1.3 (1.0)	1.1 (1.0)	0.593
Milk puddings	0.8 (0.7)	1.1 (1.0)	0.377
Fruit products [b]	0.3 (0.7)	0.1 (0.6)	0.545
Other	11.0 (5.5)	10.2 (5.4)	0.610

a Concentrate made up, ready to drink fruit drinks (not low calorie)

b Canned fruit, fruit pie fillings, fruit puree etc (not fresh fruit)

*t-test of differences between intervention and control group

The data clearly show that non-diet carbonated soft drinks were contributing the greatest amount of non-milk extrinsic sugar in the children's diets. This was observed in both the control and the intervention group - 25% and 26% respectively. Sugar and chocolate confectionery were contributing to 24% (intervention group) and 21% (control group) of the total intake of non-milk extrinsic sugar in the children's diets. Fruit drinks, biscuits, cakes and baked goods were also prominent contributors to non-milk extrinsic sugar intake at baseline.

Table 8.15 Mean percentage contribution of foods and food groups to non-milk extrinsic sugar intake in children in the intervention and control group at post-intervention (T1)

Food Type	Mean (SD)percentage contribution to total NME sugar intake		
	Intervention (*n*=84)	Control (*n*=83)	P value*
Non-diet carbonated drinks	30.4 (17.3)	29.3 (18.2)	0.687
Fruit Drinks [a]	7.9 (4.9)	11.2 (6.3)	0.053
Confectionery	24.4 (16.6)	18.0 (12.7)	0.005
Cakes, biscuits & baked goods	6.3 (4.9)	9.0 (4.8)	0.025
Breakfast cereals	6.3 (1.0)	5.0 (1.6)	0.302
Pure fruit juice	3.4 (0.6)	6.0 (0.8)	0.024
Table sugar	6.1 (2.8)	4.6 (2.1)	0.144
Ice cream	2.6 (2.5)	3.6 (3.0)	0.108
Puddings	2.0 (1.6)	2.4 (1.9)	0.427
Preserves and sweet spreads	1.2 (0.2)	0.9 (0.)	0.667
Milk puddings	0.6 (0.5)	1.0 (0.7)	0.238
Fruit products [b]	0.2 (0.7)	0.1 (0.2)	0.197
Other	8.7 (4.2)	9.2 (4.4)	0.745

a Concentrate made up, ready to drink fruit drinks (not low calorie)
b Canned fruit, fruit pie fillings, fruit puree etc (not fresh fruit)
*t-test of differences between intervention and control group

At post-intervention the contribution of non-diet carbonated soft drinks to the total non-milk extrinsic sugar intake of the children increased in both groups to 30% in the intervention group and to 29% in the control group. A similar contribution was made by confectionery in the intervention group to that of baseline and a reduced contribution observed in the control group. Fruits drinks, cakes and biscuits continued to be important contributors to the intake of non-milk extrinsic sugar in both groups. At post-intervention the control group were observed to be deriving a greater percentage of their total non-milk extrinsic sugar intake from cakes, biscuits and baked goods than the intervention group (significant at P=0.025). A trend towards a greater contribution to total intake by the control group in the form of fruit drinks was also observed. The contribution of sugar and chocolate confectionery in the control group was found to be significantly less in the control group than in the intervention at phase T1 (P=0.005).

Mean (SE) of changes in the contribution of foods and food groups to the intake of non-milk extrinsic sugar in the children of both groups are displayed in Table 8.16 . The contribution of table sugar in both groups increased slightly but significantly in both groups. In the control group only, the contribution of ice creams to non-milk extrinsic sugar increased slightly but significantly. The increased contribution of non-diet carbonated soft drinks to non-milk extrinsic sugar intake was observed in both groups through a non-significant tendency. No significant differences in the contribution of the various foods and food groups was observed between the intervention and control group between baseline and post-intervention.

Table 8.16 Mean (SE) of change in percentage contribution of foods and food groups to non-milk extrinsic sugar intake in children in the intervention group and control group between baseline and post-intervention (T1-TO)

Food Type	Mean (SE) percentage change in contribution to total NME sugar intake				
	Intervention (n=84)	P value**	Control (n=83)	P value**	P value*
Non-diet carbonated drinks	+4.0 (2.1)	0.069	+3.8 (2.2)	0.091	0.957
Fruit Drinks [a]	-1.5 (1.4)	0.293	+0.1 (1.3)	0.914	0.401
Confectionery	+0.5 (2.1)	0.823	-3.5 (1.8)	0.059	0.163
Cakes, biscuits & baked goods	-1.4 (1.0)	0.168	-1.0(1.2)	0.407	0.817
Breakfast cereals	+0.7 (1.4)	0.595	-1.6 (0.7)	0.987	0.629
Pure fruit juice	-7.8 (0.8)	0.103	-10.0 (1.4)	0.475	0.599
Table sugar	+1.9 (0.8)	0.027	+1.4 (0.6)	0.018	0.691
Ice cream	-.3 (0.5)	0.556	+1.2 (0.5)	0.026	0.051
Puddings	-0.5 (0.7)	0.387	+0.3 (0.5)	0.586	0.309
Preserves and sweet spreads	-0.2 (0.8)	0.550	-0.1 (0.3)	0.844	0.891
Milk puddings	-0.2 (0.2)	0.496	-0.1 (0.3)	0.933	0.743
Fruit products [b]	-0.7 (0.2)	0.569	-0.6 (0.1)	0.488	0.915
Other	-2.3 (1.6)	0.184	-1.0 (0.5)	0.987	0.630

a Concentrate made up, ready to drink fruit drinks (not low calorie)
b Canned fruit, fruit pie fillings, fruit puree etc (not fresh fruit)
** t-test of differences within groups T1-TO
*t-test of differences between intervention and control group

8.3.4 Contribution of foods and food groups to non-milk extrinsic sugar intake by sex

The contribution of foods and food groups to the intake of non-milk extrinsic sugar in girls and boys of the intervention and control group at baseline are shown in Table 8.17 and the data revealed few significant differences. Girls only in the control were found to deriving a greater percentage of their total non-milk extrinsic sugar intake from fruit drinks than girls in the intervention group

Table 8.17 Mean (SD) percentage contribution of foods and food groups to non-milk extrinsic sugar intake in boys and girls in the intervention and control group at baseline (T0)

Food Type		Mean percentage contribution to total NME sugar intake		
		Intervention (*n*=84)	Control (*n*=84)	P value*
Non-diet carbonated drinks	Boys	26.1 (16.4)	26.4 (13.0)	0.910
	Girls	26.6 (14.5)	24.8 (15.0)	0.558
Fruit Drinks [a]	Boys	12.0 (9.6)	8.2 (4.1)	0.123
	Girls	7.9 (6.9)	12.7 (7.4)	0.023
Confectionery	Boys	20.2 (2.1)	20.8 (1.9)	0.839
	Girls	26.1 (1.8)	21.7 (1.4)	0.109
Cakes, biscuits & baked goods	Boys	8.2 (1.4)	9.5 (1.0)	0.443
	Girls	7.4 (1.8)	10.4 (1.5)	0.082
Breakfast cereals	Boys	6.7 (1.8)	6.3 (1.0)	0.347
	Girls	4.9 (0.8)	4.2 (0.7)	0.726
Pure fruit juice	Boys	1.4 (0.7)	5.9 (1.7)	0.020
	Girls	4.8 (0.8)	7.6 (1.7)	0.158
Table sugar	Boys	5.3 (1.1)	3.6 (0.7)	0.225
	Girls	3.4 (0.5)	2.0 (0.6)	0.399
Ice cream	Boys	1.8 (0.4)	2.5 (0.5)	0.331
	Girls	3.5 (0.6)	2.3 (0.4)	0.113
Puddings	Boys	2.8 (1.4)	2.2 (1.4)	0.501
	Girls	2.4 (1.5)	2.0 (1.4)	0.685
Preserves and sweet spreads	Boys	1.4 (0.4)	0.7 (0.4)	0.299
	Girls	1.3 (0.7)	1.3 (0.3)	0.920
Milk puddings	Boys	0.8 (0.6)	1.2 (0.9)	0.557
	Girls	0.8 (0.5)	0.9 (0.8)	0.565
Fruit products [b]	Boys	0.4 (0.2)	0.7 (0.1)	0.839
	Girls	0.2 (0.1)	0.2 (0.1)	0.500
Other	Boys	12.9 (2.3)	12.4 (2.7)	0.889
	Girls	9.9 (1.6)	8.9 (2.1)	0.726

a Concentrate made up, ready to drink fruit drinks (not low sugar)
b Canned fruit, fruit pie fillings, fruit puree etc (not fresh fruit)
** t-test of differences within groups T1-T0
*t-test of differences between intervention and control group

Also, a non-significant tendency towards a greater contribution of cakes, biscuits and baked goods to total intake was observed in control group girls only. Boys only in the control group only were seen to be deriving a greater percentage of their total non-milk extrinsic sugar intake from pure fruit juice (P=0.020).

Table 8.18 shows the contribution of various foods and food groups to the intake of non-milk extrinsic sugar at post-intervention by boys and girls in both groups. Rather more differences were observed at post-intervention than at baseline. Non-diet soft drinks contributed to a mean of 23.6% to total non-milk extrinsic sugar intake in control group boys and to 30.5% in intervention group boys, this difference between means, however, was not found to be significant. The contribution made by non-diet soft drinks was seen to be similar in girls between groups. Confectionery was seen to be a considerable contributor to the intake of non-milk extrinsic sugar in boys and in girls of both groups at post-intervention. Confectionery contributed to 20.3% of total non-milk extrinsic sugars in the diets of the intervention group boys and to 16.5% in the control group boys. Although there was a tendency towards a greater contribution by confectionery in the intervention group boys this was not found to be significant (P=0.080). In girls, however, a significant trend towards a greater contribution made by confectionery was observed in girls of the intervention group (P=0.029).

At post-intervention there were no differences between groups for boys in the contribution made by pure fruit juices but a tendency towards a higher contribution by pure fruit juice to total non-milk extrinsic sugar intake was observed in the control group for girls. The mean (SE) of change in the percentage contribution of foods and food groups to the total intake of non-milk extrinsic sugar of boys and girls between phase T0 and phase T1 are presented in Table 8.19 . Boys in the intervention groups significantly decreased the contribution made by fruit drinks to their intake of non-milk extrinsic sugar between phase T0 and T1 (P=0.040). The contribution by table sugar to non-milk extrinsic sugar intake by girls in the intervention group increased significantly by 2.5% (P=0.017). The contribution of non-diet soft drinks in the diet's of girls only in the control group to their intake of non-milk extrinsic sugar increased by 7.8% and was found to be significant at P=0.012. Table 8.19 presents limited significant differences in changes between sexes of both groups. The exceptions are a slight but significant increase in the contribution of fruit drinks to non-milk extrinsic sugar intake in boys of the control group coupled by a decrease in boys in the intervention group (P=0.040). In girls of the control a non-significant tendency (P=0.052) towards a very small increase in the contribution of ice creams was observed.

Table 8.18 Mean (SD) percentage contribution of foods and food groups to non-milk extrinsic sugar intake in boys and girls in the intervention and control group at post-intervention (T1)

Food Type		Mean percentage contribution to total NME sugar intake		
		Intervention (*n*=84)	Control (*n*=84)	P value*
Non-diet carbonated drinks	Boys	30.5 (18.3)	23.6 (15.3)	0.116
	Girls	30.3 (16.9)	32.6 (19.1)	0.528
Fruit Drinks [a]	Boys	6.6 (5.9)	9.5 (5.4)	0.193
	Girls	8.7 (4.2)	12.1 (7.9)	0.140
Confectionery	Boys	20.3 (3.0)	16.5 (2.1)	0.080
	Girls	25.3 (2.3)	18.8 (1.8)	0.029
Cakes, biscuits & baked goods	Boys	5.9 (1.2)	11.9 (1.8)	0.009
	Girls	6.4 (1.0)	7.3 (1.0)	0.524
Breakfast cereals	Boys	9.4 (2.5)	5.3 (1.2)	0.152
	Girls	4.5 (0.7)	4.8 (0.7)	0.728
Pure fruit juice	Boys	3.6 (1.2)	6.1 (1.4)	0.202
	Girls	3.4 (0.8)	6.0 (1.1)	0.079
Table sugar	Boys	6.2 (1.4)	5.8 (1.1)	0.824
	Girls	6.0 (0.9)	3.8 (0.7)	0.083
Ice cream	Boys	2.4 (0.8)	4.3 (0.8)	0.127
	Girls	2.7 (0.4)	3.2 (0.5)	0.471
Puddings	Boys	2.2 (0.6)	3.5 (0.7)	0.159
	Girls	1.8 (0.5)	1.8 (0.4)	0.870
Preserves and sweet spreads	Boys	0.7 (0.3)	1.0 (0.3)	0.522
	Girls	1.4 (0.6)	0.9 (0.2)	0.471
Milk puddings	Boys	0.8 (0.3)	1.7 (0.6)	0.249
	Girls	0.5 (0.2)	0.7 (0.2)	0.677
Fruit products [b]	Boys	0.0 (0.1)	0.2 (0.4)	0.205
	Girls	0.4 (0.2)	0.1 (0.4)	0.065
Other	Boys	9.0 (1.7)	11.2 (2.2)	0.385
	Girls	8.6 (1.7)	8.0 (0.9)	0.647

a Concentrate made up, ready to drink fruit drinks (not low calorie)
b Canned fruit, fruit pie fillings, fruit puree etc (not fresh fruit)
*t-test of differences between intervention and control group

Table 8.19 Mean (SE) of change in percentage contribution of foods and food groups to non-milk extrinsic sugar of boys and of girls in the intervention and control group between baseline and post-intervention (T1-T0)

Food Type		Mean percentage change in contribution to total NME sugar intake				
		Intervention (*n*=84)	P value**	Control (*n*=83)	P value**	P value*
Non-diet carbonated drinks	Boys	+4.5 (4.1)	0.290	-2.8 (3.1)	0.378	0.167
	Girls	+3.7 (2.5)	0.137	+7.8 (3.0)	0.012	0.303
Fruit Drinks [a]	Boys	-5.4 (2.5)	0.040	+1.3 (2.0)	0.511	0.040
	Girls	+0.8 (1.5)	0.580	-0.6 (1.8)	0.758	0.549
Confectionery	Boys	+2.8 (3.0)	0.360	-4.3 (3.0)	0.177	0.107
	Girls	-0.9 (2.9)	0.759	-2.9 (2.2)	0.189	0.579
Cakes, biscuits & baked goods	Boys	-2.3 (1.7)	0.204	+2.3 (1.8)	0.225	0.078
	Girls	-0.9 (1.3)	0.471	-3.05 (1.7)	0.071	0.318
Breakfast cereals	Boys	+2.7 (3.2)	0.412	-1.0 (1.2)	0.066	0.289
	Girls	-0.4 (0.9)	0.639	+0.5 (0.8)	0.137	0.420
Pure fruit juice	Boys	+2.3 (1.1)	0.064	-1.0 (1.3)	0.426	0.437
	Girls	-1.4 (1.0)	0.189	-1.6 (1.9)	0.494	0.928
Table sugar	Boys	+0.8 (1.5)	0.570	+2.2 (1.1)	0.226	0.485
	Girls	+2.5 (1.0)	0.017	1.1 (0.7)	0.619	0.256
Ice cream	Boys	+0.5 (1.0)	0.225	+1.8 (0.9)	0.603	0.419
	Girls	-0.9 (0.6)	0.178	+0.8 (0.6)	0.280	0.052
Puddings	Boys	-0.6 (0.8)	0.412	+1.3 (1.0)	0.084	0.154
	Girls	-0.5 (0.9)	0.559	-0.2 (0.6)	0.162	0.815
Preserves and sweet spreads	Boys	-0.7 (0.5)	0.210	+0.3 (0.6)	0.859	0.225
	Girls	+0.09 (0.8)	0.908	-0.3 (0.4)	0.413	0.641
Milk puddings	Boys	-0.6 (0.5)	0.453	+0.4 (0.8)	0.617	0.599
	Girls	-0.2 (0.3)	0.439	-0.3 (0.3)	0.378	0.878
Fruit products [b]	Boys	-0.4 (0.1)	0.016	-0.02 (0.1)	0.923	0.110
	Girls	+0.1 (0.2)	0.574	-0.07 (-0.09)	0.389	0.381
Other	Boys	-4.0 (3.0)	0.399	-1.3 (3.1)	0.426	0.533
	Girls	+1.3 (1.9)	0.412	+0.9 (2.5)	0.494	0.917

a Concentrate made up, ready to drink fruit drinks (not low sugar)
b Canned fruit, fruit pie fillings, fruit puree etc (not fresh fruit)
*t-test of differences between intervention and control group

8.3.5 Frequency of intake of sugary foods

The frequency of intake of sugary foods and beverages are presented in Table 8.20 and shows a significant greater frequency intake of sugary foods and beverages by children in the control group at both baseline (5.7 times a day) and post-intervention (5.1 times a day) compared to that in the intervention group; 4.5 times a day at baseline and 5.1 times a day in the intervention (P=0.048).

Table 8.20 Mean frequency of intake and changes in frequency of intake of confectionery and foods and beverages containing non-milk extrinsic sugars of children in the intervention and control group at T0, T1 and between phases (T1-T0)

	Mean (SD) frequency of intake and mean (SE) of change in intake		
	Intervention (n=84)	Control (n=83)	P value*
Frequency of intake at baseline (T0)	5.0 (1.8)	5.7 (2.0)	0.034
Frequency of intake at post-intervention (T1)	4.5 (0.1)	5.1 (0.1)	0.048
Change in frequency of intake (T1-T0)	-0.4 (0.2)	-0.6 (0.2)	0.590

* t-test of differences between intervention and control group

8.3.6 Intake of acidic foods and beverages

Table 8.21 presents the intake of acidic foods and beverages by children at phase T0.

Table 8.21 Mean (SD) intake of acidic foods and beverages in children in the intervention and control group at baseline (T0)

Food Type	Mean (SD) of intake		
	Intervention (n=84)	Control (n=83)	P value*
All carbonated drinks [a] (g/day)	522 (82.2)	569 (101.2)	0.197
All fruit drinks [b] (g/day)	164 (29.4)	184 (26.3)	0.452
Pure fruit juice (g/day)	44 (74.6)	84 (120)	0.024
Fruit [c] (g/day)	47 (9.5)	43 (12.7)	0.676
Selected acidic foods (g/day)[d]	776 (152.8)	880 (174.2)	0.076

a Includes non-diet and diet carbonated drinks (excluding carbonated water)
b Concentrate made up, ready to drink fruit drinks, includes low calorie and non-low calorie drinks
c Fresh and tinned fruit (excluding bananas)
d Total selected acidic foods and beverages (g)
*t-test of differences between intervention and control group

Data presented in Table 8.21 show that children in both groups were consuming more than half a litre of carbonated soft drinks (diet and non-diet) each day. The total consumption of selected acidic foods and beverages was 776g/day in the intervention group and 880g/day in the control group. Of this total, fresh and tinned fruit makes a small contribution of just 47g in the intervention group and 43g in the control group. Pure fruit juice contributed significantly more towards the total consumption of acidic foods and beverages in the control group (87g/day) compared to that of the intervention group (44g/day) (P=0.010). A non-significant tendency towards a higher total consumption of acidic foods and beverages was observed in the control group at baseline.

The intake of acidic foods and beverages by children of both groups at phase T1 are displayed in Table 8.22. The data show that intakes of all carbonated soft drinks are similar between the two groups but a non-significant tendency towards a higher intake of all fruit drinks was observed in the control group.

As at baseline, pure fruit juice consumption by children in the control remains significantly greater at 75g/day compared to 40g/day in the intervention group. Total fresh and tinned fruit intakes in the two groups are similar at post-intervention. A non-significant tendency towards greater total intakes of acidic foods and beverages by children in the control group was observed.

Table 8.22 Mean (SD) intake of acidic foods and beverages in children in the intervention and control group at post-intervention (T1)

Food Type	Mean (SD) of intake		
	Intervention (*n*=84)	Control (*n*=83)	P value*
All carbonated drinks [a] (g/day)	467 (124.2)	486 (117.3)	0.602
All fruit drinks [b] (g/day)	123 (15.5)	167 (31.2)	0.075
Pure fruit juice (g/day)	40 (75)	75 (117)	0.003
Fruit [c] (g/day)	49 (7.9)	48 (6.6)	0.904
Selected acidic foods (g/day)[d]	679 (218.6)	775 (212.4)	0.080

a Includes non-diet and diet carbonated drinks (excluding carbonated water)
b Concentrate made up, ready to drink fruit drinks, includes low calorie and non-low calorie drinks
c Fresh and tinned fruit (excluding bananas)
d Total selected acidic foods and beverages (g)
*t-test of differences between intervention and control group

Mean (SE) of changes in intake of acidic foods and beverages in the children are presented in Table 8.23 . Both groups show a non-significant tendency towards a decrease in the total daily consumption of all types of carbonated soft drinks although this decrease was not found to significant in either group. The intervention group were seen to demonstrate a non-significant tendency towards a decrease in their consumption of all types of fruit drinks ($P=0.063$) but a significant increase in their intake of fresh and tinned fruit.

A non-significant tendency towards an increase in the intake of fresh and tinned fruit was observed in the control group. A decrease in the total amount of acidic foods and beverages consumed by children in both groups was found be significant. Overall, no significant differences between changes in intake of acidic foods and beverages between the intervention and control group were observed.

Table 8.23 Mean (SE) of change in intake of acidic foods and beverages in children in the intervention and control group at baseline (TO)

Food Type	Mean (SE) of change in intake				
	Intervention (*n*=84)	P value**	Control (*n*=83)	P value**	P value*
All carbonated drinks [a] (g/day)	-55 (32.4)	0.093	-84 (34.5)	0.080	0.538
All fruit drinks [b] (g/day)	-40 (21.4)	0.063	-16 (10.2)	0.321	0.395
Pure fruit juice (g/day)	-4.7 (0.8)	0.759	-9.4 (7.2)	0.000	0.819
Fruit [c] (g/day)	+3 (0.8)	0.010	+5 (0.2)	0.078	0.823
Selected acidic foods (g/day) [d]	-97 (46.9)	0.041	-104 (48.7)	0.000	0.913

a Includes non-diet and diet carbonated drinks (excluding carbonated water)
b Concentrate made up, ready to drink fruit drinks, includes low calorie and non-low calorie drinks
c Fresh and tinned fruit (excluding bananas)
d Total selected acidic foods and beverages (g)
*t-test of differences between intervention and control group
** t-test of differences within groups

8.3.7 Intake of acidic foods and beverages by sex

The mean (SD) of intake of acidic foods and beverages by boys and by girls in both groups at baseline are displayed in Table 8.24. The data show that there were no significant differences between boys in the intervention and control group for boys in total intake of acidic foods and beverages. In girls, however, total intake was revealed to be significantly higher in girls of the control group (P=0.018). A non-significant tendency towards greater consumption of all types of carbonated drinks and all fruit drinks was observed in girls only of the control group. Boys in the control group were found to be consuming significantly higher amounts of pure fruit juice than boys in the intervention group.

The children's intake of acidic foods and beverages at post-intervention are displayed in Table 8.25. There was no significant difference in the consumption of all types of carbonated drinks between either boys or girls.

At phase T1, girls in the control group were observed to be consuming significantly more fruit juice than those in the intervention group (P=0.033). There were no differences between groups for boys in the total consumption of acidic foods and beverages. In the control group girls however were observed to be consuming a greater total amount of the selected foods and beverages, significant at P=0.045.

Table 8.24 Mean (SD) of intake of acidic foods and beverages in boys and in girls of the intervention and control group at baseline (T0)

Food Type		Mean (SD) of intake		
		Intervention (*n*=84)	Control (*n*=83)	P value*
All carbonated drinks [a] (g/day)	Boys	581.7 (94.4)	567.1 (127.1)	0.804
	Girls	485.6 (82.0)	570.4 (101.7)	0.074
All fruit drinks [b] (g/day)	Boys	207.6 (28.4)	157.4 (33.5)	0.259
	Girls	137.2 (47.0)	199.0 (38.9)	0.065
Pure fruit juice (g/day)	Boys	24.9 (13.8)	77.7 (43.3)	0.020
	Girls	55.6 (36.7)	88.2 (55.8)	0.122
Fruit [c] (g/day)	Boys	34.5 (11.2)	57.6 (9.6)	0.645
	Girls	42.0 (17.8)	40.2 (13.4)	0.872
Selected acidic foods (g/day)[d]	Boys	868.9 (169.8)	849.9 (177.5)	0.842
	Girls	720.4 (152.3)	897.6 (182.0)	0.018

a Includes non-diet and diet carbonated drinks (excluding carbonated water)
b Concentrate made up, ready to drink fruit drinks, includes low calorie and non-low calorie drinks
c Fresh and tinned fruit (excluding bananas)
d Total selected acidic foods and beverages (g)
*t-test of differences between intervention and control group

Table 8.25 Mean (SD) intake of acidic foods and beverages in children in the intervention and control group at post-intervention (T1)

Food Type		Mean (SD) of intake		
		Intervention (*n*=84)	Control (*n*=83)	P value*
All carbonated drinks [a] (g/day)	Boys	506.2 (173.0)	464.2 (190.6)	0.485
	Girls	442.7 (115.9)	496.9 (100.0)	0.217
All fruit drinks [b] (g/day)	Boys	131.6 (62.8)	157.8 (83.0)	0.519
	Girls	118.9 (23.9)	172.9 (27.1)	0.084
Pure fruit juice (g/day)	Boys	48.3 (47.3)	86.0 (47.0)	0.232
	Girls	34.1 (26.5)	68.5 (41.6)	0.033
Fruit [c] (g/day)	Boys	42.0 (18.5)	41.0 (17.5)	0.952
	Girls	53.7 (31.2)	52.3 (12.9)	0.912
Selected acidic foods (g/day)[d]	Boys	728.2 (149.7)	749.1 (135.6)	0.816
	Girls	648.8 (179.3)	790.6 (182.2)	0.045

a Includes non-diet and diet carbonated drinks (excluding carbonated water)
b Concentrate made up, ready to drink fruit drinks, includes low calorie and non-low calorie drinks
c Fresh and tinned fruit (excluding bananas)
d Total selected acidic foods and beverages (g)
*t-test of differences between intervention and control group

The mean (SE) change (T1-T0) in the intake of acidic foods and beverages by the intervention and control groups by sex between baseline and post-intervention are shown in Table 8.26. Girls in the intervention group demonstrated a significant increase in their intake of fruit of 11.8g/day and girls in the control increased their intake of fruit by a mean 12g/day. Boys in both groups also increased their intake of fruit but this was not found to be significant. A very small but significant increase in consumption of all types of fruit drinks was observed in boys in the control and a larger increase in girls of the same group was observed. This increase in fruit drinks was found to be significant in both boys and girls of the control group. There were no significant differences in changes in intake of acidic foods and beverages found between boys or between girls of the intervention and control group.

Table 8.26 Mean (SE) of change in intake of acidic foods and beverages in boys and girls in the intervention and control group between baseline and post-intervention (T1-T0)

Food Type		Mean (SE) of change in intake				
		Intervention (*n*=84)	P value**	Control (*n*=83)	P value**	P value*
All carbonated drinks [a] (g/day)	Boys	-75.5 (48.0)	0.178	-102.2 (53.4)	0.088	0.704
	Girls	-42.8 (43.1)	0.719	-73.4 (45.3)	0.393	0.629
All fruit drinks [b] (g/day)	Boys	-76.2 (22.8)	0.191	+1.3 (20.3)	0.002	0.136
	Girls	-19.1 (25.1)	0.787	+26.2 (21.7)	0.000	0.832
Pure fruit juice (g/day)	Boys	+23.4 (19.8)	0.199	+8.3 (3.2)	0.529	0.696
	Girls	-21.5 (12.2)	0.369	+19.7 (19.5)	0.000	0.941
Fruit [c] (g/day)	Boys	+6.5 (0.9)	0.349	-16.5 (0.5)	0.109	0.721
	Girls	+11.8 (11.1)	0.049	+12.1 (8.9)	0.013	0.983
Selected acidic foods (g/day)[d]	Boys	-140.6 (65.7)	0.249	-100.0 (80.3)	0.018	0.702
	Girls	-71.6 (64.2)	0.800	-107.2 (61.7)	0.300	0.690

a Includes non-diet and diet carbonated drinks (excluding carbonated water)
b Concentrate made up, ready to drink fruit drinks, includes low calorie and non-low calorie drinks
c Fresh and tinned fruit (excluding bananas)
d Total selected acidic foods and beverages (g)
*t-test of differences between intervention and control group
** t-test of differences within groups between baseline and post-intervention

8.3.8 Frequency of intake of acidic foods and beverages

The frequency of the children's intake of acidic foods and beverages are displayed in Table 8.27. Frequency of intake of acidic foods and beverages in the children are similar to those of selected sugary foods and beverages. At baseline, mean frequency of consumption of acidic foods and beverages by children in the intervention group is 5 times a day which decreases to 4.5 times a day at post-intervention. The control group were found to be consuming acidic foods and beverages 5.7 times a day at baseline and 5.1 times a day at post-intervention. At both phases, frequency of consumption was less in the intervention group and this was found to be significant at baseline and post-intervention. Both groups demonstrate a reduction in the number of times day at which they consume acidic foods and beverages although there was no significant difference in change in frequency between the two groups.

Table 8.27 Median frequency of intake and changes in frequency of intake of acidic foods and beverages of children in the intervention and control group at baseline (T0), post-intervention (T1) and between baseline and post-intervention (T1-T0)

	Median (IQ range) frequency of intake		
	Intervention (*n*=84)	Control (*n*=83)	P value*
Frequency of intake at baseline (T0)	5.0 (4-6)	5.7 (5-6)	0.034
Frequency of intake at post-intervention (T1)	4.5 (4-5)	5.1 (4-5)	0.048
Change in frequency of intake (T1-T0)	-0.4 (0-1)	-0.6 (0-1)	0.590

* Mann-Whitney test of differences between intervention and control group

8.3.9 *Choice of bedtime beverages*

The choice of bedtime beverages by children of the control and intervention group at baseline is shown in Table 8.28.

Table 8.28 Bedtime beverage selection of children in the intervention and control group at baseline (T0)

Type of beverage consumed within half an hour of bedtime or after 10.30pm◊	Percentage (%) of children making beverage selection (6 days dietary data) Intervention (*n*=84)	Control (*n*=83)
Milk	22	21
Milk sweetened with sugar	8	13
Cocoa (sachet, instant)	14	11
Cocoa, made with milk[a], sweetened with sugar	5	2
Tea or coffee	5	2
Tea or coffee sweetened with sugar	3	3
Pure fruit juice	4	5
Fruit drink[b]	10	14
Carbonated soft drinks[c]	23	22

◊ Within half an hour of specified bedtime or after 10.30pm where a bedtime was not recorded
a Skimmed, semi-skimmed and whole milk
b Concentrate fruit drinks made up with water
c Includes diet and non-diet carbonated drinks

The data presented in Table 8.28 show that at baseline children in both groups were more often choosing to have milk or a carbonated soft drink as a bedtime drink. Unsweetened cocoa and all types of fruit drinks were also a popular choice. Bedtime beverage selection by the children at post-intervention is presented in Table 8.29. The percentage of children in the intervention group and control group choosing to have a carbonated soft drink at bedtime increased by approximately one third to 32% in the intervention and to 35% in the control group. The percentage of children choosing milk as a bedtime drink decreased in both groups from 22% to 10% in the intervention group and from 21% to 9% in the control group. An increase in the percentage of children choosing to have tea or coffee, and tea or coffee sweetened with sugar, also increased in both groups between baseline and post-intervention. The percentage of children choosing pure fruit juice as a bedtime beverage also increased in both groups between phases from 4% to 10% in the intervention group and from 5% to 9% in the control. The percentage of children selecting instant cocoa fell between baseline and intervention.

Table 8.29 Bedtime beverage selection of children in the intervention and control group at post-intervention T1

Type of beverage consumed within half an hour of bedtime or after 10.30pm◊	Percentage (%) of children making beverage selection (6 days dietary data)	
	Intervention (n=84)	Control (n=83)
Milk	10	9
Milk sweetened with sugar	8	10
Cocoa (sachet, instant)	4	3
Cocoa, made with milk[a], sweetened with sugar	3	3
Tea or coffee	15	10
Tea or coffee sweetened with sugar	8	10
Pure fruit juice	10	9
Fruit drink[b]	10	11
Carbonated soft drinks[c]	32	35

◊ Within half an hour of specified bedtime or after 10.30pm where a bedtime was not recorded
a Skimmed, semi-skimmed and whole milk
b Concentrate fruit drinks made up with water
c Includes diet and non-diet carbonated drinks

8.3.10 Contribution of non-diet carbonated soft drinks to mean daily energy intake

The contribution of non-diet carbonated soft drinks to the mean daily energy intakes of the children in the intervention group and control group at baseline and post-intervention are displayed in Table 8.30 . The data show that the mean percentage contribution to daily energy intake in the children by non-diet *carbonated* drinks was 8.4% in the intervention group at baseline and 9% in the control group at baseline. At post-intervention, the percentage contribution increased in both groups to 10.3% in the control group and to 9.5% in the intervention group. At baseline, a significant trend towards a higher percentage contribution of non-diet soft drinks was observed in the control group girls (P=0.038). This trend persisted into the post-intervention group and was again significant at P=0.014.

Table 8.30 Mean (SD) percentage contribution of non-diet carbonated soft drinks to mean daily energy intake of children in the intervention and control group at baseline (T0), post-intervention (T1) and mean (SE) of changes in percentage contribution T1-T0

Phase		Mean (SE) % contribution to daily energy intake Intervention (*n*=84)	Control (*n*=83)	P value*
% contribution at T0	All	8.4 (3.8)	9.0 (4.7)	0.255
	Boys	7.8 (3.9)	7.2 (4.0)	0.603
	Girls	8.7 (3.8)	10.0 (4.8)	0.038
% contribution at T1	All	9.5 (4.9)	10.3 (4.9)	0.188
	Boys	9.3 (3.7)	8.9 (4.2)	0.441
	Girls	9.7 (3.9)	11.2 (5.1)	0.014
% change in contribution T1-T0	All	+1.1 (0.5)	+1.3 (0.6)	0.353
	Boys	+1.5 (0.9)	+1.6 (0.9)	0.419
	Girls	+.09 (0.7)	+1.1 (0.8)	0.397

* t-test of differences between intervention and control group

8.4 Discussion

Primary analysis of the data concerning intake of total sugars and non-milk extrinsic sugars showed the data to be normally distributed within both groups. The median intakes of total sugars were within 1% of the mean value and median intakes of non-milk extrinsic sugars were found to be within 2.3% of the median values. These findings concur with those of other macronutrients in the diets of the children. The method employed in the isolation of foods known to contribute to the intake of non-milk extrinsic sugar is suggested to be suitable for the children participating in this study as they are derived from a thorough analysis of the types of foods and the food codes most frequently used in data processing. These particular codes are probably unique to this particular data set and subjects and may not be transferable or reliably repeatable in other sub-sets or studies.

One limitation of the foods identified and isolated as major sources of non-milk extrinsic sugars is the grouping of many various and miscellaneous foods that contribute to the rather ambiguous 'other' group. This group contains many foods but the main contributors are likely to be sweetened yoghurts and fromage frais, chilled and frozen desserts, baked beans, tinned peas and carrots and even ready-prepared frozen pizzas. A further and more detailed primary analysis of the food codes used most frequently may reveal some significant sources that may be important enough to stand alone in this type of analysis. This 'other' sources group was found to contribute at least 10% towards the children's total average daily intake of non-milk extrinsic sugars, comparable to say, fruit drinks (concentrated and diluted with water). The foods and beverages isolated in the method used in this study do concur, however, with the foods and beverages isolated in the NDNS of children aged 4-18-years. The difficulties experienced when trying to precisely identify those foods which are contributing to the non-milk extrinsic sugars intake in the children taking part in this study are probably identical to those experienced by parents and consumers trying to purchase healthier choices for themselves and their children. Extrinsic sugars are indeed 'hidden' sugars and the consequences of this are well-known to health professionals, in particular nutritionists, dietitians and dentists.

The method employed to isolate bedtime beverages was found to be the most time consuming of all those in the analysis of sugars intake. All children participating were asked to record their bedtime on each day of their dietary diary but many appeared to find it difficult to comply with this. The isolation of individual food codes entered when a bedtime was specified was time-consuming as it involved hand-searching many of the diaries for missing entries. A nominal bedtime of 10.30pm was 'given' to all subjects not specifying a time. This allowed a query to be written for all beverages consumed after this time to be constructed with some ease and a similar query could also be written for foods consumed after bedtime if this were deemed of interest, since it was apparent that children do 'graze' after bedtime. Two separate files of information were constructed and then combined. This method was most time-consuming for a small result - data were sorted and transferred to a spreadsheet for further analysis.

For future reference, all bedtimes foods and beverages require entry onto a main database with a separate field and table in order to make the analysis more straightforward. The data presented in Section 8.3.9 only serve to show the choices of the children according to nine arbitrary groups and do not provide details of quantities. The data did not reveal the total percentage of children taking a bedtime drink or how often during the recording period (of the total of six days at each phase) they consumed a drink at bedtime. The data have revealed, however, some interesting findings in terms of how the children's choices changed and show the move from milk drinks to fruit drinks and carbonated soft drinks at bedtime which has some implications for the dental health of the children.

In order to determine the children's intake of acidic foods and beverages, reference was made to those foods detailed in the report of Walker *et al*, (2000) on the oral health survey of the NDNS young people aged 4-18-years. Those foods and beverages identified for further analysis in this study are identical to those of the NDNS survey. Alcoholic beverages, although recorded on very few occasions, and also vinegar were excluded from the analysis. Lemon juice was included amongst the foods isolated as a fruit juice. Several beverages in particular were included in the quantification of acidic foods and beverages and of sugary foods and beverages. For example, all fruit juice drinks (non-low calorie) as well as non-diet carbonated soft drinks. The method employed in the calculation of the percentage contribution made by carbonated soft drinks to the mean daily energy intakes in the children made use of a general factor for kJ value. A mean value for energy per 100g of carbonated beverages was calculated from the range of values for each of the seven food codes used. This was determined to be 162 kJ/100g product.

The children's intake of total sugars contributed to approximately 20% of their total daily energy intake. At baseline, the average daily total sugars intake of the children in the control group was 127g and in the intervention group 117g. At post-intervention the mean daily intake fell to 113g in the intervention group and to 120g in the control group. These values compare favourably to those published in the NDNS of 122g/day in boys aged 11-14-years, to that of 99g in girls (Gregory *et al*, 2000) and to 111g in all children in the same age group (Walker *et al*, 2000).

When the data from this study are presented by sex, the boys intake of total sugars was above that reported in the NDNS - 133g/day in intervention group boys and 144g/day in control group boys at baseline. The mean daily intake, although tending to fall at post-intervention, was still above that of the NDNS data at 128g/day (intervention group boys) and 139g/day (control). An earlier study by Hackett *et al* (1984) reported a mean total sugars intake of 124g/day in boys and 113g/day in girls aged 11-12-years-old. A similar tendency towards lower intakes in girls as shown in the NDNS was mirrored in the average daily intake of total sugars in girls participating in this study. At baseline, average total sugars intake in the control group girls was 117g/day and in the intervention group 108g/day, both these values are above that of girls in the NDNS which was reported to be 99g/day but still lower than that of boys of the same age. In girls, a similar reduction in mean total sugars intake was observed between baseline and post-intervention to 104g/day in the intervention group and 109g/day in the control. Both groups demonstrated a reduction in the mean daily intake of non-milk extrinsic sugars and in the percentage of daily energy derived from total and non-milk extrinsic sugars following the intervention. This reduction, therefore, cannot be attributed specifically to attendance at the Food Club, although, as discussed in Chapter 6, the act of participating in a dietary survey may have had some possible influence upon intake of sugars by the children.

The children's intake of non-milk extrinsic sugars are also above the values reported in the NDNS for children of a similar age. Gregory *et al* (2000) reported a mean non-milk extrinsic sugars intake of 90g/day in boys, 73g/day in girls and Walker *et al* (2000) reported mean intakes of 82g/day in all children aged 11-14-years-old. The data reported in this study indicate that the children participating in this study had a higher intake of non-milk extrinsic sugars, particularly seen in boys in the control group.

Within group paired t-test determined that the mean change in the percentage of energy the children derived from both total sugars and non-milk extrinsic sugars decreased between the two phases and that the decrease was highly significant. At phase T0, only 28 children out of the possible 167 were consuming an average of 60g or less (the current recommendation) of non-milk extrinsic sugars per day whereas 41 were consuming 120g/day or more (twice the current UK DRV). At post-intervention, the number of children consuming less than 60g/day was 34 and the number consuming 120g/day or more fell to 26.

Non-milk extrinsic sugar typically contributes between 60-70% of total dietary sugars (Department of Health, 1991). In this study, non-milk extrinsic sugar was found to be accountable for approximately 79% of the total dietary sugars intake of the children at baseline and for 78% of total daily dietary sugars at post-intervention. This also reflects the children's low intake of milk and dairy foods as shown in the analysis of foods consumed by the National Food Guide grouping. As a result, milk sugars has reduced and accounts for less of total sugars intake.

Gregory *et al* (2000) reported that non-milk extrinsic sugars contributed to approximately 16% of total daily energy in the diets of children aged between 11-14-years-old. The contribution of non-milk extrinsic sugars to the total daily energy intake in children in this study was found to be slightly higher at baseline; 17% in the intervention group and 18% in the control. At post-intervention the fall in contribution was found to be highly significant.

Despite this encouraging change the amount of energy that the children were deriving from non-milk extrinsic sugars was still well above the value of 11% recommended for children of this age (DoH, 1991). The change in intake of non-milk extrinsic sugar cannot be isolated to the intervention group and as such cannot be attributed to attendance to the Food Club.

The children's total intake of sugary foods and beverages are higher than those of children participating in the NDNS. Walker *et al* (2000) reported a mean daily intake of sugary and beverages of 524g in children aged 11-14-years. At baseline, the average daily intake of similar foods and beverages was determined to be 659g/day in intervention children and 760g/day in control children. These values are to be expected when the sugars intake of the study children were also higher than those reported by Gregory *et al* (2000). The values fall in the post-intervention period to 588g/day in the intervention group and to 669g/day in the control group with the higher intakes in the control being found to be statistically significant. The changes within groups in the consumption of sugary foods and beverages favoured a reduction which was significant within both groups.

Those foods contributing the greatest proportion of non-milk extrinsic sugars were found to be non-diet carbonated soft drinks, fruit drinks, confectionery, cakes; biscuits and baked goods and 'other' foods. Table sugar and sweetened breakfast cereals also contributed a smaller proportion of non-milk extrinsic sugars. Collectively, beverages were found to be contributing to 40% of the children's total intake of non-milk extrinsic sugar. This possibly further reflects the beverage choices of children and teenagers - they are making a move away from milk drinks and fruit juices preferring to drink still and carbonated fruit drinks. This has the potential to impact upon the dental health of children. Given that children at school are allowed a free choice of beverages at lunchtime, coupled with the greater independence of teenagers in making their own choice of beverage, both at home and outside, it would appear that this trend will continue.

In terms of presenting clear messages to children about the possible dangers of consuming too many foods containing non-milk extrinsic sugars, there are many obstacles. Whilst table sugar is recognisable to children as 'sugar', it may be very difficult to inform children about the non-milk extrinsic sugar content of many everyday foods such as breakfast cereals, fruit drinks, carbonated drinks, baked beans, tomato ketchup, tinned peas and so on. Most children of school age are aware that eating too many sweets are not conducive to good oral health but it is not until the mid-teenage years (perhaps age 14 or 15 or so) that most are able to grasp abstract concepts - that is, if they cannot see, touch or feel the sugar in a food then it is difficult for them to understand that it is actually present! In view of the sub-optimum intakes of calcium in the children taking part in this study, any advice that may confuse children about the consumption of dairy products may probably best be avoided. Milk puddings, sweetened yoghurts and ice creams were not observed to be contributing large amounts of non-milk extrinsic sugars to the diets of the children.

In the case of breakfast cereals, many children's cereal products are fortified with a range of vitamins and minerals and will likely be eaten with milk, so children are likely to benefit from the consumption of these foods in terms of micronutrients, but perhaps not in terms of extrinsic sugars. In addition, school children are told that they should eat a healthy breakfast as a good start to the school day and messages about breakfast cereals containing too much sugar may do a lot of harm. The interpretation of information about sugars in breakfast cereals may dissuade children from having breakfast or further impact upon children and teenagers (especially girls) already trying to reduce or control their weight.

The most likely rogue to target in the reduction of non-milk extrinsic sugars in the diets of children is carbonated soft drinks, closely followed by fruit drinks. The data presented in this study show that children are consuming the equivalent to one and a half cans of carbonated drink each day. A further analysis of the children's consumption of soft drinks shows that these beverages were contributing up to 11% of the total daily energy intake in the form of non-milk extrinsic sugar. So, these children are obtaining between 8% and 11% of their daily energy intake from one food source, which, when the nutritional content of *carbonated* drinks can be considered to be nil, becomes a most alarming observation. These types of beverages will not be contributing to the micronutrient intake of the children at all and will also likely be potentially detrimental to dental health.

A further analysis of the data on place of purchase or consumption may be useful in pinpointing the occasions where carbonated drinks and other fruit drinks are consumed. Within UK primary schools, a pilot scheme has been set up to allow primary school aged children to take bottled water into the classrooms, initially to combat dehydration, fatigue and poor concentration in the classroom (DATA, personal communication, 2002). A strategy such as this may also allow children to become more accustomed to drinking water in place of sweetened soft drinks although it may be more difficult to implement and support in older children and teenagers. This is not to mention the potential benefits to oral health.

Secondary schools may also have to look closely at any policy to allow soft-drink vending machines on their premises and to include health information messages about *carbonated* drinks in lesson time. Ultimately, the food and drinks manufacturing industry has some ethical responsibility towards the way in which carbonated and still soft drinks are marketed and advertised. At present, carbonated drinks have a very 'cool' image which is most important to older children and teenagers which presents a large obstacle to overcome.

The children's intake of acidic foods are higher those reported by Walker *et al* (2000). Walker and colleagues report the mean daily intake of acidic foods in children aged 11-14-years-old to be 682g/day. At baseline, intakes in the intervention group showed a mean daily intake of 776g/day and 880g/day in the control group. All types of carbonated drinks (excluding carbonated water) by far make the largest contribution to the intake of acidic foods at baseline. A similar picture was seen at post-intervention, although average daily intakes fell to 679g/day in the intervention group and to 775g/day in the control group. Again, carbonated drinks were seen to be the largest contributor to acidic beverages.

The children's frequency of intake of both selected sugary foods and drinks and of acidic foods and drinks were approximate to five times a day at both baseline and post-intervention. Frequency of intake of sugary foods and beverages was seen to fall slightly at post-intervention and frequency of consumption was significantly greater in the control group at both phases. When the data are coupled with the amount of sugary foods and drinks that the children were consuming, these become more significant. A similar frequency of intake of acidic foods and beverages was observed in children at baseline and post-intervention. Advice to older children and teenagers on the consumption of foods containing non-milk extrinsic sugars and/or acids must also be accompanied by advice in simple terms on the frequency of consuming these types of foods. Presently, it most widely accepted that a maximum of four separate occasions be recommended for the consumption of foods containing non-milk extrinsic sugars and acids. Before this kind of information can be interpreted by children and teenagers it would be first be necessary to define very simply the kinds of foods that should be limited (i.e. carbonated drinks) and then provide some guidelines on how much and how often these foods can be consumed.

Walker and colleagues (2000) reported than one in seven young people who took part in the NDNS had a drink in bed every night but that those aged 11-14-years were the least likely (8%) to have a drink every night. Most interestingly, 20% of respondents in the NDNS reported having water to drink at bedtime whereas children in this study have not recorded one single entry for water at bedtime! This may be because they did not remember or did not consider it to be necessary to enter water at bedtime, although water is recorded as a daytime drink by many of the children, commonly as bottled or carbonated water. A further analysis of the beverages consumed by the children participating in this study may shed more light on the consumption of water and the importance of water as a beverage. With reference to bedtime grazing habits, Hackett and colleagues (1984) reported that in 405 English children aged 11-12-years-olds, between 2-3% of their total sugars intake was consumed after 22.00 hours.

At baseline, unsweetened milk (whether recorded as consumed hot or cold) accounts for 22% of bedtime beverage choices in the intervention group and for 21% in the control group. Sweetened milk accounted for 8% of choices in children of the intervention group and for 13% in the control group. Fruit drinks were also observed to be a popular choice, accounting for 10% and 14% respectively. Carbonated drinks were the most popular choice of bedtime drink at baseline, contributing to 23% of total selection in the intervention group and to 22% in the control.

At post-intervention, carbonated drinks were again observed to be the most popular choice of bedtime drink, accounting for some 32% of choices in the intervention group and for 35% in the control group (an increase in both groups). The choice of milk reduced at the post-intervention period and accounted for 10% of choice in the intervention group and for 9% in the control. Tea and coffee and sweetened tea and coffee also increased in popularity at phase T1 - this perhaps reflects the shift of children towards drinks perceived as 'adult' drinks. Within this period the children may be more inclined to drinking tea and coffee at bedtime despite the caffeine content of these drinks which probably make them less suitable as bedtime drinks for younger children.

In summary, the consumption of total sugars and of non-milk extrinsic sugars by the children is greater than that reported by Gregory *et al* (2000) and Walker *et al* (2000) for all social groups. The percentage contribution of total sugars and non-milk extrinsic sugars to total daily energy fell in both groups at post-intervention. The mean intake of non-milk extrinsic sugars by the children exceeded the DRV of 60g/day and the recommended contribution of 11% to energy intake. The main contributors to the non-milk extrinsic sugars intake in the children's diets were non-diet carbonated soft drinks, fruit drinks and confectionery. Non-diet and diet carbonated soft drinks were also the main contributors to the total intake of acidic foods by all children.

The frequency of consumption of sugary and acidic foods and beverages exceeded the guideline of four times a day and the mean frequency of consumption of these foods by the children was found to be five times a day at both phase T0 and T1. The changes observed in intake and contribution of total and non-milk extrinsic sugars in the children's diet were not found to be statistically significant and therefore it is concluded that attendance to the Food Club did not have an impact upon intake of these nutrients in the children's diets.

The children's preferred bedtime drinks were found to be non-diet and diet carbonated soft drinks and fruit drinks with a tendency towards higher consumption of tea and coffee and sweetened tea and coffee in the post-intervention phase. It is concluded that all these observations allow tentative suggestions to be made about the potential impact upon the children's oral health (in the absence of an oral examination) in favour of reducing consumption and frequency of consumption of carbonated soft drinks, fruit drinks and confectionery. The choices of bedtime drinks were poor in terms of safeguarding dental health. A major area of concern was the contribution of carbonated soft drink to the children's daily energy intake - contributing as much as 11% to energy but in no manner to the micronutrient intake of the children.

Figure 9-1 Comment from girl (age 13, control school) on completing first food diary

Have you any comments about what you have eaten during the 3 days?

Chips Are very faty
for you and tast very
Lovely thow help Me Stop
eaten to men chips.

Do you think you have eaten as you would usually do?

yes i have eaten Every things
I Would and I eat chips with I
Would like to stop eating Bu
I cont stop eating chips

9.1 Introduction

Information on the nutrition knowledge combined with cooking confidence of any particular group in the UK is scarce and it is extremely difficult to refer to published studies that have deliberately sought to investigate the nutritional knowledge and confidence in cooking skills of children and adolescents from socially deprived backgrounds. Lower social class children have been shown to have lower daily intakes of many micronutrients (Doyle *et al*, 1994, Adamson *et al*, 1992a, Moynihan *et al*, 1993) and the improvement of the diets of these children has been identified as a priority for research by Roe *et al* (1998) and earlier by Ruxton & Kirk (1996) (see Chapter 2).

However, the assumption that giving people dietary advice and information about food will empower them to make positive dietary changes and have a measurable effect upon diet and food choice is now accepted as flimsy (Anderson *et al*, 1998). In adolescents, knowledge of the nutrition has been reported to be adequate (Seaman *et al*, 1997, Gallagher, 2000) but the knowledge nutrient content of common foods has not been found to relate significantly to their macronutrient intake (Gibson *et al*, 1998). Brown *et al* (2000) reported a similar gap between nutritional awareness and dietary practices in Northern Irish 11-16-year-olds but reported that the implementation of good dietary practice was more likely to take place within home and particularly at the family evening meal. This leads to the assumption that parents are having some influence or control in this situation. In addition, when considering the need of low-income groups and less-educated groups of the population, it becomes more important to identify the most effective means of communicating information. Parmenter *et al* (2000) suggest that lower socio-economic groups and less-educated group of people may not have access to nutritional information and dietary advice and deal with new information poorly.

At the present time there does not appear to be consensus of opinion on the most widely used measure of nutrition knowledge in young people or even a clear and collectively accepted definition of nutrition knowledge. The same may be said of cooking confidence. An individual's confidence in his or her own ability to cook does not appear to have been much of issue and this is very likely because it was assumed until the last two decades at any rate, that most people - at least most women - knew about basic cooking skills. This assumption is not as outrageous as it may first seem when one considers that until the late 1980's, every girl attending school in the UK was indeed taught to cook (as were boys, perhaps to a lesser extent but the sex imbalance in receiving cooking tuition has already been discussed in Chapter 1).

It would seem then that the possession of cooking skills and the confidence to use them has only become a point of query when health professionals and probably many other people, for example, in the catering industry realised that it was possible that the decline of cooking in schools had the potential to impact upon quality of diet and in the case of the catering industry, perhaps the quality of new entrants was less than desirable. This, however, is mere speculation but on the issue of cooking skills and confidence - it *is* indeed now an issue.

A limited number of research studies have sought to measure the nutrition knowledge and food skills in children and adolescents and a review of this literature reveals some variety in the methods and approaches adopted. Watt and Sheilham (1996) investigated the knowledge of food and health of 479 adolescents aged 13-14-years-old living in Camden, London. Watt and Sheilham used a self-completed questionnaire containing knowledge statements. The authors reported that the majority of their sample demonstrated a good knowledge of food and nutrition. Ninety percent of respondents agreed that sweets and soft drinks could damage teeth, 70% agreed that low-fat milk was generally better for people than full-fat milk and 95% agreed that eating fruit and vegetables for good for people. Respondents also demonstrated some knowledge of the link between poor diet and chronic disease; 74% agreed with the statement that 'a poor diet increases most peoples chances of a heart attack'. 32% of the sample indicated agreed with the statement ' I don't know enough about foods which are good for you'.

Seaman and colleagues (1997) investigated the nutrition knowledge and lunchtime eating habits of 103 adolescents aged 13-14-years-old living in Lothian, Scotland using a questionnaire and 4-day dietary diary in order to examine any association between the two. Seaman *et al* reported that levels of nutrition knowledge were 'good'. 95% of children could identify the benefits of eating fruits and vegetables, consuming low-fat milk (96%) and lower fat meat products (83%). 89% of children were reported to be aware of current healthy eating guidelines. Whilst 50% of children reported eating fruit every day, analysis of dietary diaries revealed that in reality only 10% of the children actually ate fruit every day!

Watt and Sheilham also included a statement on interest in cooking. 23% of respondents indicated that they disagreed with the statement ' Learning to cook interests me a lot', 22% were not too concerned either way and 9% indicated they didn't know if it interested them or not. 46% of the sample indicated, however, that they agreed with this statement. The authors reported that a mere 5% of their sample indicated that they helped with cooking at home on a daily basis. Investigation into food skills revealed that the main experiences of cooking involved baking, grilling and frying. One interesting finding of this study is that only 13% of respondents indicated that learning to cook at school was important and that the major source of learning to cook was the family (84%).

In their review of cooking skills and health, Lang and colleagues (1999) investigated confidence in cooking skills of 5,553 subjects included in the Health Education Authority's 1993 Health and Lifestyles Survey. Respondents indicated that they were most confidence in the more traditional cooking skills; boiling (90%), grilling (90%), baking and roasting (80%), shallow frying (75%) and deep frying (65%). Respondents were least confident in their ability to steam (54%) and to stir-fry (55%). However, analysis by social class revealed that respondents from social classes I, II, and IIIN were much more confident in using steaming, poaching, microwaving and stir-frying than those from social classes IV and V. Younger people (those aged 16-19-years) were shown to confident in their ability to cook potatoes (92%), fresh green vegetables (81%), pasta (78%) but much less confident in their ability to cook oily fish (18%), pulses (37%) and white fish (40%).

It would seem reasonable to suggest that a person with an interest in food preparation and cooking would naturally learn more about foods and their nutrient content and be better able to put a meal together and to do so with confidence. With experience, greater confidence in using a variety of cooking skills and food preparation techniques and the skills required to use kitchen equipment is gained. Without the confidence to cook there may be more reliance upon ready-prepared meals and, in the case of lower social groups, pressure to purchase cheaper brands of ready-prepared meals which have a questionable nutrient content.

9.1.1 Aims

The aims of this analysis were to:

- **Measure the nutrition knowledge of children of 167 children aged 11-13-years-old from deprived social backgrounds prior to and following a school-based controlled dietary intervention**

- **Measure the children's knowledge food preparation and knowledge of cooking skills**
- **Measure the children's perceived confidence in their ability to cook**

9.2 Method

A questionnaire was used to investigate knowledge of nutrition (NK), knowledge of food preparation (FPK) and perceived confidence in cooking skills (PC). Four pilot studies were undertaken, 3 in Dundee and 1 in Tyne and Wear, where reliability for test, re-test analysis and discrimination and difficulty indices were performed (see Anderson *et al*, 2002).

All children participating in the study were asked to complete a questionnaire at baseline and the same questionnaire again at post-intervention. The questionnaires were completed by children in school under the supervision of research staff. No time limit was set for the completion of questionnaires. Children were informed that the questionnaire was not a test but its purpose was to find out their opinions and how much they knew about food and healthy eating. Children were asked not to discuss the questionnaire with one another whilst they were completing it, although research staff were at hand to answer any queries. The parents of children who were absent from school on the day of the visit were contacted and a home visit arranged in order to complete the questionnaire. Where a home visit was necessary, other families were tactfully asked not to assist their child with any questions.

The final questionnaire comprised 27 questions; food preparation and cooking knowledge (9 questions), perceived confidence in cooking skills (9 questions), nutrition knowledge (10 questions). All questions were purposely designed and validated; for further information please refer to Moynihan (2001[a]) and to Anderson *et al* (2002).

9.2.1 Food Preparation: Ingredients and Cooking Knowledge Questions (Section 1)

The questions used in Section 1 of the questionnaire were designed to assess knowledge of basic food preparation and the skills required to prepare familiar dishes. Questions relating to knowledge of ingredients were designed using commonly consumed meal items; coleslaw salad, lentil soup, bread, and apple crumble (Table 9.1).

Table 9.1 Food preparation: ingredients knowledge questions 1-4

Question No	Question	Possible correct answers	Possible score
1	What are the main ingredients needed to make coleslaw?	Cabbage, carrots, onion, a dressing	4
2	What are the main ingredients needed to make lentil soup?	Lentils, onions, other vegetable, liquid (water/stock etc)	4
3	What are the main ingredients needed to make bread?	Flour, yeast, fat (butter, lard, etc), liquid (water/milk)	4
4	What are the main ingredients need to make apple crumble?	Apples, flour, sugar, fat (butter/margarine)	4

Total possible score: 12

A further five questions investigated children's knowledge of appropriate cooking times. These questions were designed to reflect meal items commonly consumed (boiled potatoes, rice, pasta etc). Approximate cooking times for the meal items used where informed by either manufacturer's recommended cooking times (in the case of pasta and rice etc) or to guidelines given in standard texts (McCance and Widdowson, 1991).

The questions, with appropriate answers, are displayed in Table 9.2 .

Table 9.2 Food preparation: cooking knowledge questions 5-9

Question No 5-9 How long do you think the following foods would take to cook?	Multiple choice answers				Possible score
	About 5 minutes	About 10 minutes	About 15 minutes	About 20 minutes	
5. Vegetable stir fry					1
6. Broccoli					1
7. Pasta Shells (not quick cook)					1
8. Boiled white rice					1
9. Boiled potatoes					1

Total possible score: 5

9.2.2 Perceived Confidence in Cooking Skills Questions (Section 2)

The questions in this section were designed to assess the children's perceived ability to prepare several common meal items that would be familiar to the children. The meal items chosen for this section were directly related to those in Section 1. A multiple choice format was used for answering this question in order to avoid many categories of answers which may make score quantification difficult.

Children were thus provided with a four-category response grid in order to be able to choose either; 'all by myself'; 'with a little help; 'with a lot of help' or 'not at all'. Questions 1-9 in this section are displayed in Table 9.3.

Table 9.3 Perceived confidence in cooking skills questions 1-9

Question No 1-9 Without using a packet/ready-made foods, rate your ability at making the following foods.	Multiple choice answers				Possible score
	All by myself 3 points	With a little help 2 points	With a lot of help 1 point	Not at all 0 points	
1. Vegetable stir fry					0-3
2. Coleslaw					0-3
3. Boiled potatoes					0-3
4 Lentil soup					0-3
5. Apple crumble					0-3
6. Boiled white rice					0-3
7. Boiled pasta					0-3
8. Bread					0-3
9. Boiled broccoli					0-3

Total possible score for Perceived Confidence in Cooking Skills Section: 27

9.2.3 Nutrition Knowledge Questions (Section 3)

The questions relating to nutrition knowledge were designed to assess the children's knowledge of the nutrition content of familiar commonly consumed meals. As a basis point for each question, the correct answer contained a food item or meal in which either 50% of energy would be derived from a starchy carbohydrate and less than 35% of energy from fat, or in which there was a specific reference to fruit and vegetables content (see Table 9.4).

Table 9.4 Nutrition knowledge questions 1-8

Question 1. Many breakfast foods are healthy choices. Which one of the following breakfast type foods would be the 'healthiest' choice?	
One fried sausage	
One fried bacon rasher	
One fried egg	
One slice bread and jam	
Not sure	

Question 2. Many snack foods are healthy choices. Which one of the following items would be the 'healthiest' one to take as a between meals snack?	
A plain digestive biscuit	
A chocolate bar	
A kiwi	
An orange ice lolly	
Not sure	

Question 3. Which one of the following breakfast type foods would NOT be a good example of a healthy snack?	
One bowl of wholewheat cereal	
An apple	
A sausage roll	
A slice of toast and jam	
Not sure	

Question 4. Many packed lunches are healthy choices. Which one of the following lunches would be the 'healthiest' choice?	
Crisps, chocolate bar and fizzy drink	
Meat pie, fruit yoghurt and milk	
Cheese salad roll, apple and water	
Pizza, chocolate bar and milkshake	
Not sure	

Question 5. Many sandwiches are healthy choices. Which one of the following sandwich fillings would be the 'healthiest' choice?	
Cheddar cheese and onion	
Bacon and tomato sauce	
Chicken, lettuce and tomato	
Egg mayonnaise	
Not sure	

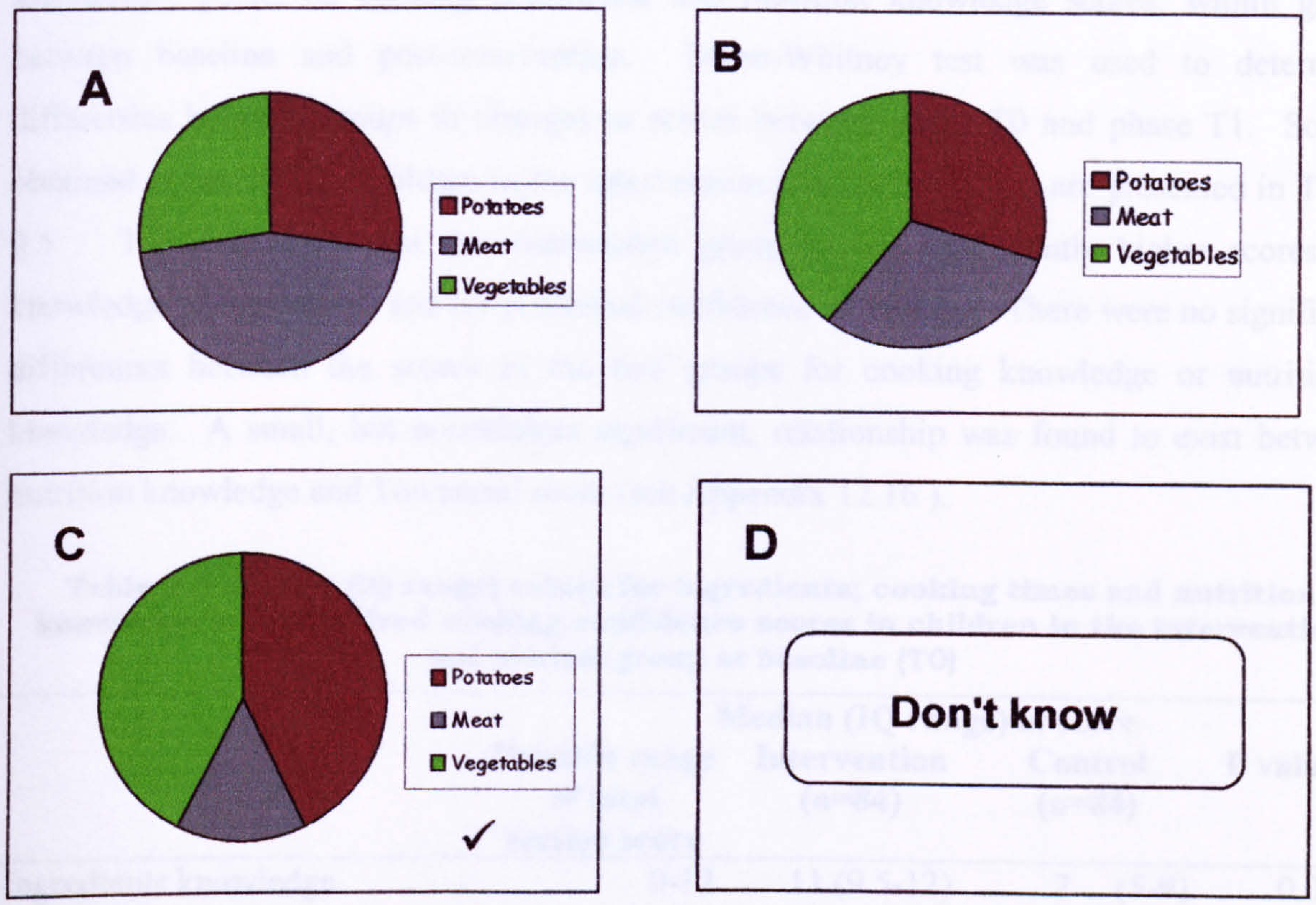
Question 6. Many potato dishes are healthy choices. Which one of the following types of potatoes would be the 'healthiest' choice?	
Medium portion of roast potatoes	
Medium portion of chips	
Medium baked potato (no filling)	
Medium portion mashed potato & butter	
Not sure	

Question 7. In general, how many portions of fruit and vegetables are recommended by healthy experts to be eaten every day?	
1 or less	
Two to three	
Four	
Five or more	
Not sure	

Question 8. Which sandwich is healthier?	
Two thin slices of bread and a thick slice of cheese	
Two thick slices of bread and a thin slice of cheese	
One thick slice of bread and a thick slice of cheese	
All the same	
Not sure	

Figure 9-2 Nutrition Knowledge Question 9

Question 9. A main meal can sometimes be made up of such foods as potatoes, meat and vegetables. Which one of the plates shows the 'healthiest' proportions of the different foods? Circle one only - A, B, C, or D.



9.2.4 Data processing and analysis

Primary processing of questionnaires required each of the questionnaires to be marked and scores awarded for the responses recorded. Scores were then entered onto a Microsoft Access Database purposely constructed for the study (see Section 3.2.9). Scores were then summed for each section of the questionnaire on a subject by subject basis. Resulting data were subsequently transferred to SPSS for analysis.

Mean food preparation knowledge, perceived cooking confidence and nutritional knowledge scores were determined for the intervention and control group at baseline and following intervention. Differences in total mean scores within groups between baseline and post-intervention were determined using paired t-test and differences between groups in total mean scores were investigated using t-test.

9.3 Results

Primary analysis of the data showed the data not be normally distributed. Wilcoxon signed rank test was used to determine statistically significant changes in ingredients and cooking knowledge, perceived cooking confidence and nutrition knowledge scores. within group between baseline and post-intervention. Mann-Whitney test was used to determine differences between groups in changes in scores between phase T0 and phase T1. Scores obtained at baseline by children in the intervention and control group are presented in Table 9.5 . The data show that the intervention group gained significantly higher scores for knowledge of ingredients and for perceived confidence in cooking. There were no significant differences between the scores of the two groups for cooking knowledge or nutritional knowledge. A small, but nonetheless significant, relationship was found to exist between nutrition knowledge and Townsend score (see Appendix 12.16).

Table 9.5 Median (IQ range) values for ingredients; cooking times and nutrition knowledge and perceived cooking confidence scores in children in the intervention and control group at baseline (T0)

	Possible range of total section score	Median (IQ range) of score Intervention (n=84)	Control (n=84)	P value*
Ingredients knowledge	0-12	11 (9.5-12)	7 (5-9)	0.001
Cooking knowledge	0-5	3 (3-4)	3 (2-5)	0.708
Perceived cooking confidence	0-27	22 (18-24)	17 (13-20)	0.001
Nutrition knowledge	0-9	6 (5-7)	5 (4-6)	0.900

* Mann-Whitney test of differences between groups

The scores of the children in both groups at post-intervention are displayed in Table 9.6 . No statistically significant differences between the scores of the intervention group and control group at post-intervention.

Table 9.6 Median (IQ range) values for ingredients; cooking times and nutrition knowledge and perceived cooking confidence scores in children in the intervention and control group at post-intervention (T1)

	Possible range of total section score	Median (IQ range) of score Intervention (n=84)	Control (n=84)	P value*
Ingredients knowledge	0-12	12 (9-12)	9 (7-12)	0.152
Cooking knowledge	0-5	3 (3-4)	3 (3-4)	0.961
Perceived cooking confidence	0-27	22 (18-24)	20 (16-22)	0.888
Nutrition knowledge	0-9	6 (4-7)	6 (5-7)	0.244

* Mann-Whitney test of differences between groups

Changes in nutrition knowledge, perceived confidence in cooking ability and food preparation knowledge scores of the children in the intervention group and control group between baseline and post-intervention are shown in Table 9.7. The data show that the ingredients knowledge scores and perceived cooking confidence scores of both groups increased between baseline and post-intervention. The increase in ingredients knowledge score in the control group was not found to be statistically significant but the increase in perceived cooking confidence scores was significant at P=0.001. In the intervention group the increase in both ingredients scores and perceived cooking confidence scores was found to be highly significant at P=0.001. There were no significant differences in changes in scores between the two groups.

Table 9.7 Median (IQ range) of ingredients; cooking times and nutrition knowledge and perceived cooking confidence scores in children in the intervention and control group between baseline and post-intervention (T1-T0)

	Median (IQ range) of score				
	Intervention (n=84)	P value**	Control (n=84)	P value**	P value*
Ingredients knowledge	+1 (-1- 4)	0.001	+2 (0- 4)	0.324	0.152
Cooking knowledge	0 (-1- 1)	0.390	0 (-1- 1)	0.317	0.961
Perceived cooking confidence	+2 (-1- 6)	0.001	+2 (-1- 6)	0.001	0.888
Nutrition knowledge	0 (-1- 1)	0.317	0 (-1- 1)	0.400	0.244

*Mann-Whitney test of differences between groups
**Wilcoxon signed rank test of differences within groups

Table 9.8 shows that 64% of children in the intervention group and 59% in the control group at baseline were able to identify the 'meal' containing the correct proportions of meat, potatoes and vegetables. At post-intervention, the numbers of children able to do this rose slightly in both groups to 75% and 71% respectively.

Table 9.8 Question 9 Nutrition Knowledge - Percentage of children in the intervention and control group answering correctly at baseline and post-intervention

Phase	Percentage of children answering Question 9 correctly	
	Intervention (n=84)	Control (n=83)
Percentage at T0	64	59
Percentage at T1	75	71

9.4 Discussion

The results show that at baseline the children in the intervention had higher ingredients knowledge scores and higher perceived cooking confidence scores than children in the control group. One possible explanation for this is that children in the intervention group who volunteered to take part in the study were aware that the study would include attendance to an after-school Food Club where they would have the opportunity to cook. This may have had the unintentional affect of attracting children who already had an interest in food and cooking although it was not shown to have any significant influence upon recruitment numbers (see Section 3.3.3). Children in the control group were not informed about the Food Club and as such were unaware about the practical intervention, thus it is less likely that children with an interest in cooking would have been more attracted to the study than others who were not. At post-intervention nutrition knowledge scores did not increase significantly in either group but median scores in both groups indicated a good knowledge of basic nutrition.

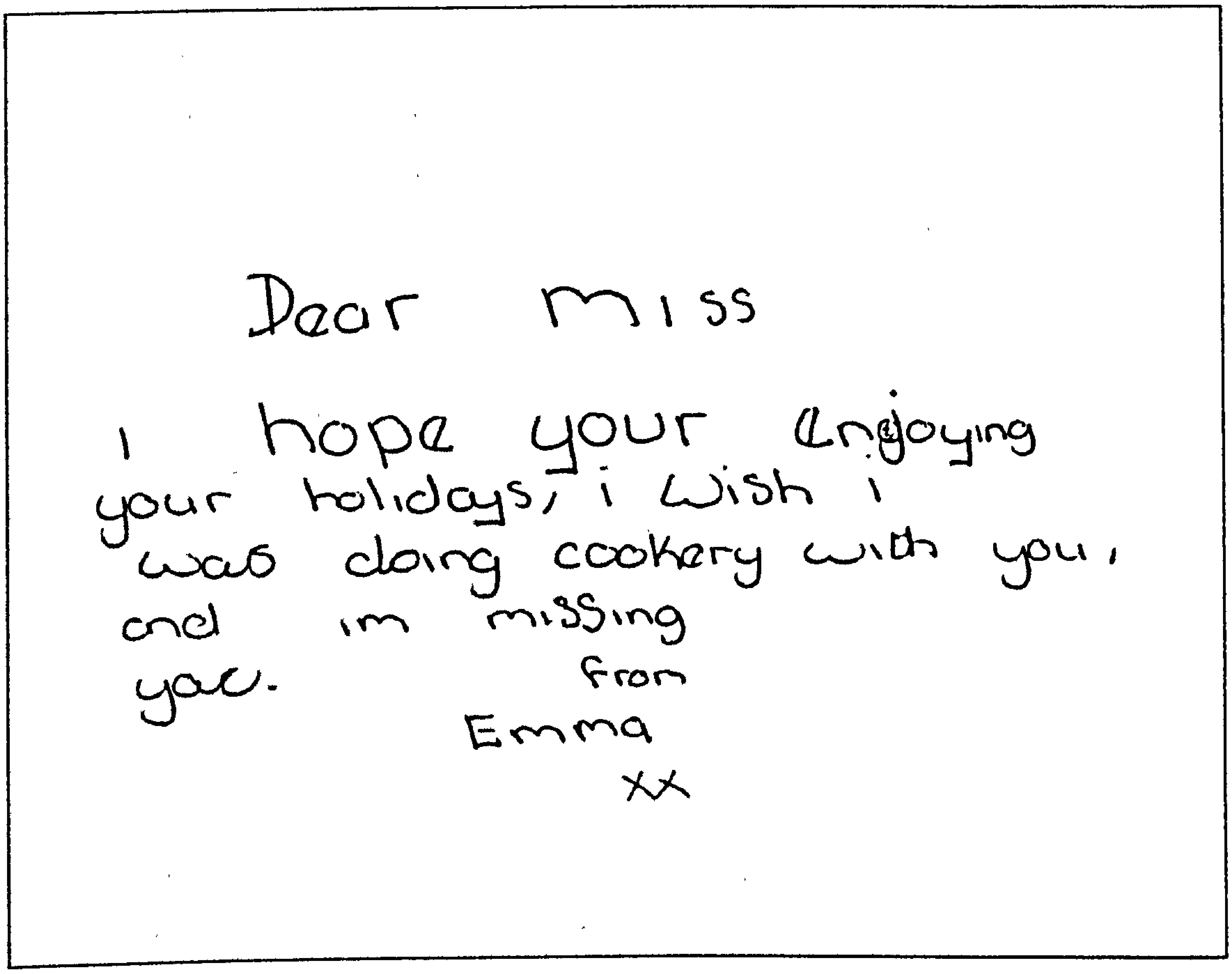
Scores relating to knowledge of ingredients were of a good standard in both the control and intervention group but were higher in the intervention group. The scores indicate that many children are aware of some basic healthy eating guidelines (see Figure 9-1) but evidence of trying to follow a healthy diet is scarce, particularly in terms of the consumption of fruits and vegetables. Median cooking confidence score in the intervention group children was 22 out of a possible 27. Both these indicate that children who had attended the Food Club had a good basic knowledge of ingredients and confidence in their ability to cook.

Ultimately, there were no significant differences in changes in scores between the intervention and control group. The most likely explanation for this is the increase in the age of the children - having a year to increase their knowledge of food and that they may have either found out or remembered the specific questions on the questionnaire they had completed at baseline. In addition, it is difficult to know whether or not children in either group may have also learnt about nutrition and healthy eating as it may be taught in Food Technology, Science on in Personal and Social Education in some schools, at different times and to different classes.

The children completed an identical questionnaire at post-intervention to that at baseline. It may have been preferable to change the content of the questions without diverting from the original assessment of knowledge. For example, the children could have been asked about the main ingredients to make a dish such as Shepherd's Pie or basic bolognese sauce rather than lentil soup. Cooking times could have been extended to include other easily recognised dishes. The questionnaire employed in the study had been initially designed for use in young women in Dundee and it is possible that further development of its suitability for adolescents may have been necessary (see Anderson *et al*, 2002).

In summary, the Food Club did not impact significantly on the nutrition and cooking knowledge and cooking confidence scores of the intervention group over and above that demonstrated in the control group. However, it should be borne in mind that the intervention was a relatively short-term programme and potential exists in programmes of a longer duration.

Figure 10-1 Letter to Mrs Tracey Cowell, Food Club Teacher, following the close of the Food Club in April 2000


Dear Miss

i hope your enjoying
your holidays, i wish i
was doing cookery with you,
and im missing
you.

from
Emma
xx

10.1 Introduction

This study has attempted to highlight the role of food preparation and cooking skills in the ability to follow a nutritionally adequate diet and draw attention to how this ability may be compromised when basic skills are limited. A review of the literature revealed that income and social inequalities impact upon quality of life and life expectancy (Section 2.1). Lower-social class groups are already at risk of a poor diet (Section 2.3) and to chronic diseases associated with dietary inadequacy, sub-optimum micronutrient intakes and dietary excesses. Several studies have shown that the nutrient intakes of low-income families are poor (Moynihan *et al*, 1993, Doyle *et al*, 1994, Ruxton & Kirk ,1996, Watt & Sheilham,1996) and that intake of fruits and vegetables do not meet current dietary reference values (Gregory *et al*, 2000). Dietary trends in adolescent nutrition reveal unsatisfactory progress towards meeting the current dietary recommendations. This has been shown to be more severe in children and adolescents from low social groups (Section 2.3). Children from low-income families are still eating too few fruits and vegetables and consume diets that are high in saturated fat and non-milk extrinsic sugars. Children also derive a greater proportion of their daily energy intake from non-milk extrinsic sugar than current dietary guidelines recommend (Department of Health, 1989, Department of Health, 1991). Current dietary trends in children and adolescents have a poor outlook in terms of minimising the risk of chronic disease in adult life and to the predisposition to dental caries in childhood.

The many changes to the National Curriculum of England and Wales have led to a decline in the traditional teaching of cooking skills to make way for a shift in emphasis towards the study of industrial food technology and manufacturing practices (Section 2.8). The teaching of 'Home Economics' ensured that shopping, budgeting, basic nutrition, food preparation and cooking skills were taught to all young people regardless of social class. Whilst some elements remain in the current curriculum subject of Food Technology the focus now is to teach young people about industrial food manufacturing, packaging, labelling and the simulated creation and production of food products using sophisticated computer software.

The review also highlights the United Kingdom's current delight and obsession with food which is also evident in the many appearances of celebrity chefs and countless television programmes entirely devoted to food and to cooking. Whilst the public's interest in food has risen and elevated the past-time of cooking for pleasure to a national hobby, the National Curriculum has been slowly squeezing cooking skills out of the curriculum along the path of technological progress. This has been accompanied by the drive to ensure that all children receive a quality education and that school-leavers have good levels of literacy, numeracy and information technology skills to reduce the impact of social exclusion and to enhance the quality of the Nation's workforce. All this means that is it becoming more difficult to allocate time within the curriculum to the teaching of foods skills.

Low-income groups are amongst the most vulnerable in the population and a review of cooking skills and health by Lang and colleagues (1999) shows that the lower social groups are more dependant upon the cooking skills they learnt at school that those from higher social class groups. The decline in the teaching of cooking skills in secondary schools will likely have the largest impact upon low-income families in the UK.

In a review of the effectiveness of dietary intervention and health promotion studies, Roe *et al* (1998) identified a shortfall of interventions targeted towards adolescents and schoolchildren. Roe and colleagues concluded there was an immediate and pressing need for dietary intervention targeted at adolescents, young people and at lower income families. Schools have been identified as a key setting for health promotion initiatives aimed at increasing young people's awareness of food and nutrition by the Department of Health (1996) but there appears to little move towards this in view of the more recent changes to the provision of food and the teaching of cooking skills in the National Curriculum under the direction of the Department for Education and Employment.

10.2 Summary and conclusions

10.2.1 Schools and Subjects

Ten schools were recruited into the study and a total of 167 children completed all aspects of the study. This thesis reported on the recruitment strategy employed to secure volunteers from socially deprived backgrounds.

The recruitment strategy of the study was successful in securing the desired number of schools and subjects to participate in the study. Valuable lessons were learnt in terms of discovering the most effective means of recruiting schools and their pupils and these findings are reported and discussed in Chapter 3. Researchers must identify the most effective means before attempting to conduct any research study in secondary schools. Since the introduction of school league tables many secondary schools are under pressure to be seen to be performing well. Pressures may be greater where a proportion of the school catchment area is known to be socially deprived and this has implications for removing children from classes to conduct dietary interviews. It is concluded that research studies carried out in secondary schools can be most productive but that is essential to identify potential obstacles. This may be best achieved by holding a series of exploratory focus groups with teaching staff and pupils.

10.2.2 *The Intervention*

This thesis reported on the intervention programme delivered to children of the intervention group. The Intervention was well received by schools and there was much evidence to show that pupils greatly enjoyed the opportunity to attend an after-school Food Club. The design and development of the Food Club were reported in Chapter 4. The median attendance of all children to the Food Club was 14 weeks whilst 50% of the intervention group attended 15 sessions or more. All materials and consumables necessary to hold the Food Club were supported by the University of Newcastle and further research into the transferability and feasibility of future Food Clubs in terms of costs and staffing is required. The value of the Food Club as a social occasion for socially deprived adolescents should not be underestimated and future alternative sources of funding must be found.

10.2.3 *Anthropometry*

The thesis reported on the anthropometrical measurements of children participating in the study in Chapter 5. Before an analysis of nutrient intake and the suitability of the chosen method of dietary assessment could be performed, it was necessary to collect and analyse anthropometric data from the children. Anthropometry was reported and discussed in Section 5.3 and Section 5.4 . The main findings show that the children's height, weight, BMR and BMI increased as to be expected in children of this age. A small negative but nonetheless significant relationship was revealed between the height of the children and degree of social deprivation and persisted despite the increase in height between baseline and post-intervention. This requires further research.

Values for BMI in the children were higher than those reported in the NDNS (Gregory *et al*, 2000) and the proportion of children whose BMI was greater than 30 was unsatisfactory. It is concluded that anthropometric measurements make more of a statement about growth and development in children of this age but may be used tentatively as indicators of dietary energy excess and may be employed in the tracking of BMI and overweight in children into adulthood. It is also concluded that along with educational messages regarding a healthy diet, such messages may need to supported with advice on personal fitness and exercise as diet alone cannot be seen a singular factor leading to overweight.

10.2.4 Main aim: evaluation of the impact of the Food Club upon intakes of foods and nutrients

This study attempted to address a number of aims. The main aim of the study was to:

- **Evaluate the impact of a school-based food preparation and cooking skills intervention on the intake of foods and nutrients in the diets of children from socially deprived backgrounds**

The intake of foods and nutrients by the children at baseline and post-intervention were analysed and the findings were reported and discussed in Chapter 6. Dietary diaries were found to be a convenient and cost-effective method of collecting dietary data from children of this age. Several obstacles were encountered when distributing and retrieving diaries from the children and these were discussed in Section 6.4 . It was necessary to explore the literacy and numeracy abilities of the children in order to make the food diaries suitable for use by a proportion of children with special needs and this factor should be taken into account in future studies involving children from socially deprived areas.

Macronutrient and micronutrient intakes and intakes of foods belonging to the five food groups of the National Food Guide were reported and discussed in Sections 6.3.1 to 6.3.2 .

10.2.4.1 Macronutrient intake

The macronutrient intakes of the children compared favourably with other published data and largely agreed with the findings of Gregory *et al* (2000) in the NDNS of children aged 4-18-years-old. Macronutrient and micronutrient intakes were reported as observed and the findings are discussed in Section 6.3 . The process of comparison to published data was complicated by the presentation of macro- and micronutrient intakes by sex in the majority of studies whereas intakes were reported by group (of mixed sex) in this study. The mean energy intakes of the children were higher than values reported in the NDNS (Gregory *et al*, 2000), by Doyle *et al* (1994) and by Adamson *et al* (1992[b]). Mean energy intakes at baseline were 8.6MJ/day in both groups and at post-intervention 9.1MJ/day in the intervention group and 9.4MJ/day in the control group. On a gender level, however, the data concur with the opinion that energy intakes in children are falling (Whitehead, 1982, Adamson *et al*, 1992a, Hackett *et al*, 1986 and Gregory *et al*, 2000).

Protein intake and the contribution of protein to daily energy intake in the children increased significantly in both groups between phases. The contribution of total fat to mean daily energy intake in the children remained consistent in the intervention group at 36.3% but increased slightly but not significantly in the control group from 35.5% at baseline to 35.9% at post-intervention. The children's intake of saturated fat increased significantly within both groups between baseline and intervention. The contribution of saturated fat to the children's mean daily energy intake increased from 12.1% to 12.5% in the intervention group and from 11.8% to 11.9% in the control. The percentage of daily energy the children derived from carbohydrate was approximate to 50% in both groups at both phases. Starch contributed to 28% of daily energy at baseline and to 29% of energy in both groups at phase T0 and T1 respectively.

The increase in energy intakes and in macronutrient intakes were to be expected in children of this age. The data show that the children's diets were almost in accordance with current Dietary Reference Values (Department of Health, 1991) but intakes of saturated fat and protein contributed a greater proportion of daily energy than is desired. The differences in changes in intake of macronutrients was not found to be significant between groups between baseline and post-intervention. It is therefore concluded that the Food Club did not impact upon the macronutrient intake of children in the intervention above that of children in the control group.

10.2.4.2 Intake of foods belonging to the five groups of the National Food Guide

In both groups the children were seen to increase their intake of foods belonging to the 'meat, fish and alternatives' group and this supports the findings that the children's intake of protein increased between baseline and post-intervention. Similarly, the children significantly increased their intake of foods from the 'starchy foods' group and again this is supported in the finding that the percentage of energy that the children were deriving from starch increased between phase T0 and T1. Conversely, whilst the children in the intervention group decreased their average consumption of foods belonging to the 'foods containing fat and sugar' group, this was not reflected in the percentage contribution made by total fat and saturated fat to their average daily energy intake. Children in the control group increased their intake of foods from this group between baseline and post-intervention.

The selection and consumption of foods from the group 'milk and dairy foods' was poor; median intakes were 53g/day in the intervention group at baseline and 60g/day in the control. At post-intervention the children's intake of 'milk and dairy foods' equated to a half a small glass of milk or a small pot of fromage frais (40g/day in the intervention group and 55g/day in the control).

Consumption of fruits and vegetables by the children did not meet the current recommendations of 5 or more portions of fruit and vegetables per day (400g/day) (WHO, 1990). At baseline both groups were consuming the equivalent to 1.5 portions of fruit and vegetables per day. At post-intervention this increased to 1.7 portions/day in the intervention group and to 1.8 portions/day in the control. Boys in the intervention group significantly increased their intake of fruits and vegetables by 39g/day. A tendency towards increased intake in fruits and vegetables by boys only in the intervention group above that of the control group was revealed.

It is therefore concluded that the Food Club did not impact upon the children's intake of foods from the National Food Guide groups but it did have a positive impact upon the consumption of fruit and vegetables by boys who attended the Food Club.

10.2.4.3 Micronutrient intake

The thesis reported and discussed the children's intake of a selection of micronutrients. (Section 6.3.3). The children's intake of Vitamin C was shown to be adequate at baseline and post-intervention. Intake of β-carotene increased in both groups between phases T0 and T1. The increase in β-carotene by boys only in the intervention than by boys in the control group is likely associated with the slightly increased consumption of fruits and vegetables demonstrated by intervention group boys only.

The children's intake of calcium was sub-optimum and is reflected by their low intake of foods belonging to the 'milk and dairy foods' group of the National Food Guide. Iron intakes, especially in girls, were low and of concern, and did not increase despite an increase in mean energy intake at post-intervention.

It is concluded that attendance to the Food Club did not impact upon the children's intake of micronutrients but it is possible that the tendency towards a greater increase in β-carotene intakes by boys only in the intervention group is connected to their increased intake of fruit and vegetables.

10.2.5 Dietary intake: validation of dietary assessment methodology

This section of the thesis had one further subsidiary aim which was to:

- **validate the method of dietary assessment using Physical Activity Levels and perform a preliminary analysis of 24-hour urine sample biochemical markers**

This thesis reported on the use of two validation techniques; the use of Physical Activity Levels (PAL) and measurement of 24-hour urinary biochemical analytes. The findings of the validation techniques were reported and discussed in Chapter 7. Mean PAL values of children in both groups at both baseline and intervention were determined to be 1.5. On a group level the ratio of the children's energy intake to their BMR was satisfactory and indicated a reasonable level of accuracy in self-reports of dietary intake. A further analysis by sex revealed lower PAL's in girls.

When the children were grouped according to PAL, those not meeting the recommended PAL (Department of Health, 1991) were found to be consuming significantly less amounts of total fat, saturated fat and sugar. This in itself suggests a possible 'Hawthorne' effect in the recording period. This is further supported by evidence at post-intervention which reveals smaller numbers of children with lower PAL's and that the children were possibly less concerned about the foods they were consuming and/or recording.

The results of the analytical procedures performed on 38 24-hour urine sample revealed that nine samples were complete. The results of other urinary analytes; urinary sodium and potassium, urinary creatinine and nitrogen were interpreted with caution out of necessity. Mean urinary potassium excretion in all samples was twice that of urinary sodium and the values reported for the ratio of urinary potassium excretion to that of urinary sodium were comparable to data published in the NDNS (Gregory *et al*, 2000).

A positive and significant relationship between urinary potassium excretion and the children's intake of fruit and vegetables was determined. It is concluded, however, that a validation technique that relies upon the collection of 24-hour samples is not suitable in free-living adolescent subjects as compliance is often poor.

10.2.6 *Subsidiary aims*

10.2.6.1 *Analysis of dietary sugars: of intake of total and non-milk extrinsic sugars and in intake and frequency of intake of sugary and acidic foods*

The thesis had two subsidiary aims. The first was to:

- **Quantify the intake and frequency of total sugars, non-milk extrinsic sugars, sugary and acidic foods in the diets of the children and identify changes within these foods and nutrients following the intervention**

This study isolated and quantified total and non-milk extrinsic sugars and identified the sources of non-milk extrinsic sugars in the diets of the children. The quantity and frequency of intake of sugary foods and beverages and acidic foods and beverages were also investigated. The findings of these analyses were reported and discussed in Section 8.3 and Section 8.4 . The children's intake of total sugars contributed to approximately 20% of their total daily energy intake. The values reported in this study are slightly higher than those reported by Gregory *et al* (2000). The children's intake of total sugars (g/day) and the contribution of total sugar to mean daily energy intake fell significantly in both groups between baseline and intervention.

Non-milk extrinsic sugars contributed 79% of total dietary sugars intake at baseline in both groups and to 78% at post-intervention. This value is slightly higher than is usual (Department of Health, 1991). Currently, the Dietary Reference Values indicate that no more than 10% of energy be derived from non-milk extrinsic sugar and that intake of these sugars should be approximate to 60g/day (Department of Health, 1991). The children's intake of non-milk extrinsic was higher than that reported by sex by Gregory *et al* (2000) and for both sexes by Walker *et al* (2000). At baseline, only 16% of children were found to be consuming 60g/day or less and at baseline 20% of the children were consuming 60g/day or less. Both the intervention group and control group demonstrated a reduction in the percentage of energy derived from non-milk extrinsic sugar between phase T0 and T1 and this decrease was significant within both groups.

Sugary foods and beverages were identified by examining the most frequently recorded entries and subsequent food codes. The method used embraced all the food items and beverages also used in the NDNS (Gregory *et al*, 2000). The method still retained a surplus or miscellaneous group containing many foods consumed in smaller quantities and further work on this data may involve extracting individual food items from this group to investigate their contribution to the children's intake of non-milk extrinsic sugars. Foods contributing the greatest proportion of non-milk extrinsic sugars at baseline and post-intervention were found to be non-diet carbonated soft drinks, fruit drinks, confectionery, cakes, biscuits and baked goods. Table sugar and sweetened breakfast cereals contributed to a lesser extent.

Collectively, beverages were found to be contributing to 40% of the children's total intake of non-milk extrinsic sugar. The children's intake of sugary foods and beverages and of acidic foods and beverages fell between baseline and intervention but frequency of intake still remained at a mean of five times a day despite the decrease in consumption. Non-diet carbonated soft-drinks were the single largest contributor to the intake of sugary foods and beverages. Non-diet and diet carbonated soft drinks were also the single biggest contributor to total intake of acidic foods and beverages.

The children's choice of bedtime drink demonstrated a shift away from taking milk drinks at bedtime towards the greater consumption of *carbonated* drinks, fruit drinks, tea and coffee and sweetened tea and coffee. A most important finding is that more than 30% of beverage selection choices was made in favour of carbonated soft drinks at bedtime.

The combination of the children's intake of non-milk extrinsic sugars, their consumption of sugary foods and beverages and acidic foods and beverages and the frequency of their intake has a potential to impact upon dental health. Fruits (fresh and tinned), pure fruit juice, table sugar and sweetened breakfast cereals were not food items that raise major concern in the children's diets.

In view of the children's low consumption of milk and dairy foods, any reduction in the consumption of breakfast cereals may possibly affect what is already a poor intake of milk and a sub-optimum intake of calcium at a stage of rapid growth in the children's lives. In addition, many breakfast cereals consumed by children are fortified and a reduction in the consumption of breakfast cereal may possibly affect what are already low intakes of iron (particularly in girls). The role of rogue falls firmly with all types of soft drinks. These findings suggest, worryingly, that there is a clear trend amongst these children away from drinking water and milk and towards drinking fruit drinks and *carbonated* drinks. It is concluded therefore that these particular consumption patterns in the children participating in this study are a cause for concern and may increase the risk of dental diseases.

10.2.6.2 Evaluation of the impact of the Food Club on the children's nutrition, food preparation and cooking knowledge and cooking skills confidence

The second subsidiary aim of the thesis was to:

- **Evaluate the impact of the intervention on the nutritional knowledge, food preparation knowledge, cooking knowledge and confidence of socially deprived children**

Chapter 8 in the thesis deals with the children's knowledge of nutrition, food preparation and cooking skills and their cooking confidence. These were assessed by the use of a self-completed questionnaire. The findings of these analyses were reported and discussed in Section 9.3 and Section 9.4 . At baseline, children in the intervention group had higher median scores for knowledge of ingredients and for perceived cooking confidence than children in the control group. At post-intervention median scores for perceived cooking confidence increased significantly within the intervention but in the control group also. Median scores for knowledge of ingredients was higher in the intervention group at baseline and the median perceived cooking confidence score at post-intervention of 22 out of a possible 27. In further research studies it may be more appropriate to use different methods of measuring cooking skills and cooking confidence. The children had been taught many practical skills during the Food Club and it may have been more useful to have performed a baseline and post-intervention measurement of the level of practical skills demonstrated by all children which would encompass the skills included in the Food Club programme. The results of this analysis as reported in Chapter 8 would lead to the assumption that children in the intervention had not improved in their actual cooking ability but it is strongly suggested that this was not so. The tools used to measure the children's practical cooking abilities following the intervention were just not the best tools for the task. If a measurement of the level of skills demonstrated by the children in, for example, peeling, chopping and preparing vegetables, using a grill and a microwave; making a casserole; making a sauce or a puree, then these measurements would have very clearly shown the benefits of the Food Club in the intervention group and reflected the quality of instruction that the children had received.

10.3 Recommendations for Government

The practical skills that children acquire throughout their time in Food Technology at school is of great benefit to their ability as adults to consume a diet in accordance with current dietary recommendations. Further changes to Food in the Design and Technology content of the National Curriculum should be made in expert consultation with organisations with specialist knowledge of Food Technology. The inclusion of the study of food as material should not be undermined by due emphasis upon industrial manufacturing practices. The teaching of practical cookery skills should not be viewed as a reversal of technological progress but embraced as a necessary and beneficial learning experience of children aged 11-16-years-old.

10.4 Recommendations for schools

The work of Food Technology teachers needs to be supported at the highest school level and by Local Education Authorities in order for the subject to enjoy the similar status afforded to other curriculum subjects. Schools should continue with their commendable support of and provision for the teaching of Food Technology to their pupils at all Key Stages.

10.5 Recommendations for Health Educators

Health promotion messages to children and adolescents need to be consistent and made using language and example that are easily understood and interpreted. Nutrition and dental health information messages regarding the consumption of beverages needs to be clarified and specific food groups identified and targeted in the reduction in intake and frequency of intake of foods rich in non-milk extrinsic sugars.

This study has shown that children's choice of beverage changed as they grew older and a significant proportion of beverages choices were made in favour of diet and non-diet carbonated soft drinks, both during the day and at bedtime. Non-diet carbonated drinks were found to be contributing to as much as 11% of mean daily energy intake. Further research is needed to investigate children's consumption of beverages and the effect upon nutrient intake and dental health.

10.6 Further work

This study has shown that the children's attendance to the after-school Food Club demonstrated their enjoyment of practical cooking activities. The impact of this short-term intervention upon intakes of foods and nutrients was limited to the exception of a positive impact upon fruit and vegetable intake in boys attending the club. Further research needs to be carried out on Food Clubs of a longer duration to investigate the long-term effects upon diet and nutrient intake in children attending similar intervention programmes. Such research may also establish the differences between boys and girls in their perception of a cooking skills club and to investigate the best means of recruiting and retaining schools and their pupils in research programmes.

The tools used to measure the children's development of practical cooking skills were not successful in identifying actual change in the acquisition of cooking skills. Further research into the tools used to measure practical cooking skills is required in order for effective measurements to be made.

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12 Appendix

12.1 National Curriculum for England: Design and Technology

The National Curriculum for England: design and technology. Source: Crown

Jointly published by

Department for Education and Skills
Sanctuary Buildings
Great Smith Street
London SW1P 3BT

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29 Bolton Street
London W1Y 7PD

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[The importance of design and technology

Design and technology prepares pupils to participate in tomorrow's rapidly changing technologies. They learn to think and intervene creatively to improve quality of life. The subject calls for pupils to become autonomous and creative problem solvers, as individuals and members of a team. They must look for needs, wants and opportunities and respond to them by developing a range of ideas and making products and systems. They combine practical skills with an understanding of aesthetics, social and environmental issues, function and industrial practices. As they do so, they reflect on and evaluate present and past design and technology, its uses and effects. Through design and technology, all pupils can become discriminating and informed users of products, and become innovators.]

Programme of study: design and technology

Key stage 3

[During key stage 3 pupils use a wide range of materials to design and make products. They work out their ideas with some precision, taking into account how products will be used, who will use them, how much they cost and their appearance. They develop their understanding of designing and making by investigating products and finding out about the work of professional designers and manufacturing industry. They use computers, including computer-aided design and manufacture (CAD/CAM) and control software, as an integral part of designing and making. They draw on knowledge and understanding from other areas of the curriculum.]

Knowledge, skills and understanding

Teaching should ensure that knowledge and understanding are applied when developing ideas, planning, producing products and evaluating them.

Developing, planning and communicating ideas

1. Pupils should be taught to:
a) identify relevant sources of information, using a range of resources including ICT
b) respond to design briefs and produce their own design specifications for products
c) develop criteria for their designs to guide their thinking and to form a basis for evaluation
d) generate design proposals that match the criteria
e) consider aesthetics and other issues that influence their planning [for example, the needs and values of intended users, function, hygiene, safety, reliability, and cost]
f) suggest outline plans for designing and making, and change them if necessary
g) prioritise actions and reconcile decisions as a project develops, taking into account the use of time and costs when selecting materials, components, tools, equipment and production methods
h) use graphic techniques and ICT, including computer-aided design (CAD), to explore, develop, model and communicate design proposals [for example, using CAD software or clip-art libraries, CD-ROM and internet-based resources, or scanners and digital cameras].

Working with tools, equipment, materials and components to produce quality products

2. Pupils should be taught:
a) to select and use tools, equipment and processes, including computer-aided design and manufacture (CAD/CAM), to shape and form materials safely and accurately and finish them appropriately [for example, using CAM software linked to a cutter/plotter, lathe, milling machine or sewing machine]
b) to take account of the working characteristics and properties of materials and components when deciding how and when to use them
c) to join and combine materials and ready-made components accurately to achieve functional results
d) to make single products and products in quantity, using a range of techniques, including CAD/CAM to ensure consistency and accuracy

e) about the working characteristics and applications of a range of modern materials, including smart materials.

Evaluating processes and products

3. Pupils should be taught to:
a) evaluate their design ideas as these develop, and modify their proposals to ensure that their product meets the design specification
b) test how well their products work, then evaluate them
c) identify and use criteria to judge the quality of other people's products, including the extent to which they meet a clear need, their fitness for purpose, whether resources have been used appropriately, and their impact beyond the purpose for which they were designed [for example, the global, environmental impact of products and assessment for sustainability].

Knowledge and understanding of materials and components

4. Pupils should be taught:
a) to consider physical and chemical properties and working characteristics of a range of common and modern materials
b) that materials and components can be classified according to their properties and working characteristics
c) that materials and components can be combined, processed and finished to create more useful properties and particular aesthetic effects [for example, combining different ingredients to create products with different sensory characteristics]
d) how multiple copies can be made of the same product.

Knowledge and understanding of systems and control

5. Pupils should be taught:
a) to recognise inputs, processes and outputs in their own and existing products
b) that complex systems can be broken down into sub-systems to make it easier to analyse them, and that each sub-system also has inputs, processes and outputs
c) the importance of feedback in control systems
d) about mechanical, electrical, electronic and pneumatic control systems, including the use of switches in electrical systems, sensors in electronic switching circuits, and how mechanical systems can be joined together to create different kinds of movement
e) how different types of systems and sub-systems can be interconnected to achieve a particular function
f) how to use electronics, microprocessors and computers to control systems, including the use of feedback
g) how to use ICT to design sub-systems and systems.

Knowledge and understanding of structures

6. Pupils should be taught:
a) to recognise and use structures and how to support and reinforce them
b) simple tests and appropriate calculations to work out the effect of loads
c) that forces of compression, tension, torsion and shear produce different effects.

Breadth of study

7. During the key stage, pupils should be taught the Knowledge, skills and understanding through:

a) product analysis

b) focused practical tasks that develop a range of techniques, skills, processes and knowledge

c) design and make assignments in different contexts. The assignments should include control systems, and work using a range of contrasting materials, including resistant materials, compliant materials and/or food .

Key stage 4

[During key stage 4 pupils take part in design and make projects that are linked to their own interests, industrial practice and the community. Projects may involve an enterprise activity, where pupils identify an opportunity, design to meet a need, manufacture products and evaluate the whole design and make process. Pupils use ICT to help with their work, including computer-aided design and manufacture (CAD/CAM) software, control programs and ICT-based sources for research. They consider how technology affects society and their own lives, and learn that new technologies have both advantages and disadvantages.]

Knowledge, skills and understanding

Teaching should ensure that knowledge and understanding are applied when developing ideas, planning, producing products and evaluating them.

Developing, planning and communicating ideas

1. Pupils should be taught to:

a) develop and use design briefs, detailed specifications and criteria

b) consider issues that affect their planning [for example, the needs and values of a range of users; moral, economic, social, cultural and environmental considerations; product maintenance; safety; the degree of accuracy needed in production]

c) design for manufacturing in quantity

d) produce and use detailed working schedules, setting realistic deadlines and identifying critical points

e) match materials and components with tools, equipment and processes, taking account of critical dimensions and tolerances when deciding how to manufacture the product

f) be flexible and adaptable in responding to changing circumstances and new opportunities

g) use graphic techniques and ICT, including computer-aided design (CAD), to generate, develop, model and communicate design proposals [for example, using CAD software to generate accurate drawings and part drawings to help with manufacturing].

Working with tools, equipment, materials and components to produce quality products

2. Pupils should be taught to:

a) select and use tools, equipment and processes effectively and safely to make products that match a specification

b) use a range of industrial applications when working with familiar materials and processes

c) manufacture single products and products in quantity, applying quality assurance techniques
d) use computer-aided manufacture (CAM) in single item production and in batch or volume production [for example, using vinyl cutters, embroiderers, knitting machines, engravers, milling machines, and lathes]
e) simulate production and assembly lines, including the use of ICT.

Evaluating processes and products

3. Pupils should be taught to:
a) check design proposals against design criteria, and review and modify them if necessary as they develop their product
b) devise and apply tests to check the quality of their work at critical points during development
c) ensure that their products are of a suitable quality for intended users [for example, how well products meet a range of considerations such as moral, cultural and environmental] and suggest modifications that would improve their performance if necessary
d) recognise the difference between quality of design and quality of manufacture, and use essential criteria to judge the quality of other people's products.

Knowledge and understanding of materials and components

4. Pupils should be taught:
a) how materials are cut, shaped and formed to specified tolerances
b) how materials can be combined and processed to create more useful properties, and how these changed materials are used in industry
c) how materials are prepared for manufacture and how pre-manufactured standard components are used
d) about a variety of finishing processes, and why they are important for aesthetic and functional reasons
e) that to achieve the optimum use of materials and components, they need to take into account the relationships between material, form and intended manufacturing processes.

Knowledge and understanding of systems and control

5. Pupils should be taught:
a) the concepts of input, process and output, and the importance of feedback in controlling systems, including:
i) how control systems and sub-systems can be designed, used and connected to achieve different purposes
ii) how feedback is incorporated into systems
iii) how to analyse the performance of systems.

Breadth of study

6. During the key stage, pupils should be taught the Knowledge, skills and understanding through:
a) product analysis
b) focused practical tasks that develop a range of techniques, skills, processes and knowledge

c) design and make assignments, which include activities related to industrial practices and the application of systems and control.

Attainment target for design and technology

Level 1
Pupils generate ideas and recognise characteristics of familiar products. Their plans show that, with help, they can put their ideas into practice. They use pictures and words to describe what they want to do. They explain what they are making and which tools they are using. They use tools and materials with help, where needed. They talk about their own and other people's work in simple terms and describe how a product works.

Level 2
Pupils generate ideas and plan what to do next, based on their experience of working with materials and components. They use models, pictures and words to describe their designs. They select appropriate tools, techniques and materials, explaining their choices. They use tools and assemble, join and combine materials and components in a variety of ways. They recognise what they have done well as their work progresses, and suggest things they could do better in the future.

Level 3
Pupils generate ideas and recognise that their designs have to meet a range of different needs. They make realistic plans for achieving their aims. They clarify ideas when asked and use words, labelled sketches and models to communicate the details of their designs. They think ahead about the order of their work, choosing appropriate tools, equipment, materials, components and techniques. They use tools and equipment with some accuracy to cut and shape materials and to put together components. They identify where evaluation of the design and make process and their products has led to improvements.

Level 4
Pupils generate ideas by collecting and using information. They take users' views into account and produce step-by-step plans. They communicate alternative ideas using words, labelled sketches and models, showing that they are aware of constraints. They work with a variety of materials and components with some accuracy, paying attention to quality of finish and to function. They select and work with a range of tools and equipment. They reflect on their designs as they develop, bearing in mind the way the product will be used. They identify what is working well and what could be improved.

Level 5
Pupils draw on and use various sources of information. They clarify their ideas through discussion, drawing and modelling. They use their understanding of the characteristics of familiar products when developing and communicating their own ideas. They work from their own detailed plans, modifying them where appropriate. They work with a range of tools, materials, equipment, components and processes with some precision. They check their work as it develops and modify their approach in the light of progress. They test and evaluate their products, showing that they understand the situations in which their designs will have to function and are aware of resources as a constraint. They evaluate their products and their use of information sources.

Level 6

Pupils draw on and use a range of sources of information, and show that they understand the form and function of familiar products. They make models and drawings to explore and test their design thinking, discussing their ideas with users. They produce plans that outline alternative methods of progressing and develop detailed criteria for their designs and use these to explore design proposals. They work with a range of tools, materials, equipment, components and processes and show that they understand their characteristics. They check their work as it develops and modify their approach in the light of progress. They evaluate how effectively they have used information sources, using the results of their research to inform their judgements when designing and making. They evaluate their products as they are being used, and identify ways of improving them.

Level 7

Pupils use a wide range of appropriate sources of information to develop ideas. They investigate form, function and production processes before communicating ideas, using a variety of media. They recognise the different needs of a range of users and develop fully realistic designs. They produce plans that predict the time needed to carry out the main stages of making products. They work with a range of tools, materials, equipment, components and processes, taking full account of their characteristics. They adapt their methods of manufacture to changing circumstances, providing a sound explanation for any change from the design proposal. They select appropriate techniques to evaluate how their products would perform when used and modify their products in the light of the evaluation to improve their performance.

Level 8

Pupils use a range of strategies to develop appropriate ideas, responding to information they have identified. When planning, they make decisions on materials and techniques based on their understanding of the physical properties and working characteristics of materials. They identify conflicting demands on their design, explain how their ideas address these demands and use this analysis to produce proposals. They organise their work so that they can carry out processes accurately and consistently, and use tools, equipment, materials and components with precision. They identify a broad range of criteria for evaluating their products, clearly relating their findings to the purpose for which the products were designed and the appropriate use of resources.

Exceptional performance

Pupils seek out information to help their design thinking, and recognise the needs of a variety of client groups. They are discriminating in their selection and use of information sources to support their work. They work from formal plans that make the best use of time and resources. They work with tools, equipment, materials and components to a high degree of precision. They make products that are reliable and robust and that fully meet the quality requirements given in the design proposal.

12.2 Membership of The Good Food Study Steering Group

- Dr Paula Moynihan, PhD, BSc, S.R.D., R.P.H.Nutr., Lecturer in Nutrition, The Dental School, University of Newcastle
- Professor John Mathers, Professor of Human Nutrition, Human Nutrition Research Centre, University of Newcastle
- Professor Annie Anderson, PhD, BSc, R.P.H.Nutr., Professor of Food Choice, Centre for Public Health Nutrition Research, University of Dundee
- Dr Ashley Adamson, PhD, BSc, S.R.D., R.N., Lecturer in Nutrition, Human Nutrition Research Centre, University of Newcastle
- Dr Rosie Stacy, PhD, BSc, Senior Lecturer in Medical Sociology, University of Newcastle
- Dr David Walshaw, PhD, BSc, Lecturer in Statistics, Department of Statistics, University of Newcastle
- Mr Paul McNamee, BSc, M.Sc., Lecturer in Health Economics, Department of Epidemiology and Public Health, University of Newcastle
- Ms Moira Hill, BSc, S.R.D., Newcastle Community Dietetics, Royal Victoria Infirmary, Newcastle upon Tyne
- Dr Simon Raybould, PhD, BSc, Senior Research Associate, Centre for Regional and Urban Development, University of Newcastle

Aspects of the study relating to the design of the questionnaire were undertaken with the consultation of Professor Annie Anderson of the Centre for Public Health Nutrition at the University of Dundee. Additional researchers were employed by the Human Nutrition Research Centre to carry out recruitment of schools and subjects, data collection and analysis and to assist in the development and delivery of the Food Club. These researchers were:

- Dr Rob Hyland, PhD, BSc. Social Scientist
- Mrs Tracey Cowell, BA, M.Sc., Teacher of Food Technology
- Ms Julie Hooper, BA, M.Sc., Research Nutritionist (family shopping information)

12.3 Use of flyers in the study recruitment strategy

Figure 12-1 Flyer designed to be attached to letter of recruitment to parents and guardians of Year 7 pupils

Dear Parents and Guardians

Too good to miss!

Let your child come to a FREE Food Club where they can cook, eat and even bring tasty food home - ALL FREE!

Each child that completes the study will receive a certificate of merit
and a £15.00 gift voucher
as a thank you for their help

What will my child have to do?

Between now and the summer, and again next spring -

- Write down what they eat and drink for 3 days
- Write down (with your help) the family food shopping for one week

From September to April go to the Food Club one night a week.

If your child would like to take part, please sign the consent slip on the following page.

To find out more, please telephone me on 0191 222 8241.

Thanks for reading this letter.

Yours truly

Dr Paula Moynihan
Newcastle University

12.4 Information sheet supplied to prospective volunteers (control group)

Human Nutrition Research Centre
Wellcome Laboratories
Queen Victoria Road
Newcastle upon Tyne
Tel: 0191 222 8241

The Good Food Study

INFORMATION SHEET

This information sheet contains details about the Good Food Study and how you and your child will be asked to contribute. Please read it carefully before you consent to your child taking part. If you have any questions about the study, please telephone the number given at the bottom of this sheet.

Taking part in the study is entirely voluntary. All the information that you and your child supply will be strictly CONFIDENTIAL. Your child may withdraw from the study at any time without giving a reason.

1. Your child will be visited at school by a Nutritionist, Mrs Sam Revill, who will supply your child with a pocket-sized Food Diary and give full instructions to your child on how this should be completed.
2. Visits to your child in school will be arranged with teaching staff. The visit will take place at a time that is convenient to the school timetable. Your child will be given a slip that will inform them of the day and the time of the visit.
3. Your child will be visited again in school on completion of the food diary. This visit will be to look through the information your child has written down and to collect the diary from him/her.
4. Your child will asked to complete two food diaries in the summer term of school this year, and two next year at about the same time.
5. The Nutritionist will also ask to visit you and your child at home, at a time that is convenient to you. The Nutritionist will ask to measure your child's height and weight and this will be written down.
6. A Nutritionist will also ask your child to fill in a questionnaire. This will be done at school this summer term and again next year about the same time.
7. In addition, Miss Julie Hooper will contact you to arrange a time to visit you at home. You (and your child, if he or she wishes) will be asked to complete a Food Shopping Diary for one week. You will be asked to fill in one Shopping Diary this year, and one next year about the same time.
8. All the information that you and your child supply will be CONFIDENTIAL.
9. Children who complete the study will be given a certificate of merit and a gift voucher as a thank you for their help.

If you have any questions, please telephone:
Dr Paula Moynihan (0191 222 8241)
Mrs Sam Revill or Miss Julie Hooper (0191 222 8719)

12.5 Intake by children in the intervention group and control group of selected vitamins at T0, T1 and T1-T0

Table 12.1 Median (IQ) of daily intake of vitamins of children in the intervention group and the control group at baseline (T0)

	Median (IQ) of daily intake Intervention n=84	Control n=83	P value*
Vitamin A (retinol equivalents)(μg)	420 (285-558)	458 (348-605)	0.704
Retinol (μg)	204 (157-312)	238 (132-348)	0.749
β-carotene (μg)	989 (658-1449)	1136 (711-1856)	0.677
Thiamin (mg)	1.5 (1-2)	1.6 (1-2)	0.248
Folate (μg)	182 (133-294)	209 (177-253)	0.371
Vitamin C (mg)	67 (40-96)	80 (53-100)	0.292
Vitamin E (mg)	6.8 (5.1-8.1)	7.7 (5.6-10)	0.826

* Mann-Whitney test of differences between intervention and control group

Table 12.2 Mean (SD) of daily intake of vitamins of children in the intervention group and the control group at baseline (T1)

	Mean (SD) of daily intake Intervention n=84	Control n=83	P value*
Vitamin A (retinol equivalents)(μg)	368 (269-489)	373 (269-549)	0.169
Retinol (μg)	192 (150-193)	193 (128-309)	0.443
B-carotene (μg)	998 (685-1449)	1136 (711-1856)	0.165
Thiamin (mg)	1.4 (1.1-1.7)	1.5 (1.1-2.1)	0.169
Folate (μg)	175 (131-220)	183 (145-229)	0.007
Vitamin C (mg)	62 (38-100)	69 (45-107)	0.021
Vitamin E (mg)	6.1 (5-9)	6.1 (5-8.8)	0.053

* Mann-Whitney test of differences between intervention and control group

Table 12.3 Mean (SE) of the change in daily intake of vitamins of children in the intervention group and the control group between baseline (T0) and post-intervention (T1)

	Mean (SD) of daily intake Intervention n=84	P value**	Control n=83	P value**	P value*
Vitamin A (retinol eq)(μg)	-1 (-26-32)	0.147	+11 (-15-39)	0.015	0.317
Retinol (μg)	0 (-100-107)	0.752	+33 (-51-140)	0.044	0.272
B-carotene (μg)	+59 (-406-628)	0.252	+191 (-425-994)	0.067	0.489
Thiamin (mg)	0 (-0.3-0.3)	0.380	+0.1 (-0.2-0.2)	0.253	0.774
Folate (μg)	+0.4 (-26-41)	0.333	+26 (-3.0-69)	0.000	0.014
Vitamin C (mg)	+11 (-101-189)	0.735	+83 (-98-234)	0.069	0.314
Vitamin E (mg)	+0.2 (-2-2)	0.504	+0.7 (-0.8-3.2)	0.003	0.072

* Mann Whitney test of differences in changes between intervention and control group
** Wilcoxon signed rank test of differences within groups

12.6 Intake of selected vitamins by boys and girls in the intervention group and control group at T0, T1 and T1-T0

Table 12.4 Median (IQ range) of daily intake of vitamins of boys and girls in the intervention and control group at baseline (T0)

		Median (IQ range) of intake Intervention Boys n=31 Girls n=53	Control Boys n=31 Girls n=52	P value*
Vitamin A (retinol equivalent)(μg)	Boys	429 (281-557)	514 (366-646)	0.166
	Girls	356 (265-425)	308 (227-479)	0.268
Retinol (μg)	Boys	267 (170-378)	255 (200-376)	0.751
	Girls	185 (126-252)	159 (99-239)	0.198
B-carotene (μg)	Boys	839 (554-1220)	1476 (579-1962)	0.039
	Girls	971 (558-1263)	845 (476 -1128)	0.259
Thiamin (mg)	Boys	1.6 (1.4-2.2)	1.8 (1.5-2.2)	0.476
	Girls	1.3 (1.1-1.6)	1.4 (1.1-1.9)	0.686
Folate (μg)	Boys	211 (144-247)	224 (172-263)	0.402
	Girls	164 (127-206)	131 (111-214)	0.780
Vitamin C (mg)	Boys	7.5 (5.3-10)	82 (50-105)	0.607
	Girls	59 (35-85)	57 (40-130)	0.461
Vitamin E (mg)	Boys	7.1 (5.3-10)	7.2 (5.2-9.1)	0.838
	Girls	5.8 (5-8.3)	6.3 (4.5-7.6)	0.853

* Mann Whitney test of differences between intervention and control group

Table 12.5 Median (IQ range) of daily intake of vitamins of boys and girls in the intervention and control group at post-intervention (T1)

		Median (IQ range) of intake		P value*
		Intervention Boys n=31 Girls n=53	Control Boys n=31 Girls n=52	
Vitamin A	Boys	429 (281-557)	503 (373-666)	0.961
(retinol equivalent)(μg)	Girls	356 (265-425)	412 (310-575)	0.072
Retinol (μg)	Boys	267 (170-378)	321 (198-427)	0.263
	Girls	185 (125-252)	184 (125-285)	0.898
B-carotene (μg)	Boys	839 (554-1220)	1127 (739-1677)	0.402
	Girls	971 (558-1263)	1159 (660-1910)	0.024
Thiamin (mg)	Boys	1.6 (1.4-2.2)	1.9 (7.3-11.5)	0.871
	Girls	1.3 (1.1-1.5)	1.3 (5.1-8.8)	0.104
Folate (μg)	Boys	211 (144-247)	237 (209-311)	0.101
	Girls	164 (126-206)	190 (156-219)	0.027
Vitamin C (mg)	Boys	76 (40-106)	98 (57-129)	0.257
	Girls	59 (35-86)	78 (50-102)	0.037
Vitamin E (mg)	Boys	7.1 (5.3-10)	9.3 (7.3-11.5)	0.056
	Girls	5.8 (4.9-8.3)	6.8 (5.1-8.8)	0.140

* Mann Whitney test of differences between intervention and control group

Table 12.6 Median (IQ range) of change in daily intake of vitamins of boys and girls in the intervention and control group between baseline (T0) and post-intervention (T1)

		Median (IQ range) of intake				
		Intervention Boys n=31 Girls n=53	P value**	Control Boys n=31 Girls n=52	P value**	P value*
Vitamin A (ret equiv) (μg)	Boys	+66 (-52-218)	0.044	+27 (-180-190)	0.999	0.193
	Girls	+20 (-130-147_	0.870	+119 (-59-262)	0.200	0.011
Retinol (μg)	Boys	-6 (-84-126)	0.984	+54 (-58-172)	0.189	0.349
	Girls	+6 (-105-100)	0.801	+20 (-50-113)	0.152	0.405
B-carotene (μg)	Boys	+424 (-370-1106)	0.020	-263 (-676-383)	0.224	0.021
	Girls	-8 (-428-330)	0.617	+321 (-186-1067)	0.002	0.002
Thiamin (mg)	Boys	0 (-0.3-0.3)	0.337	+0.2 (-0.2-0.2)	0.224	0.927
	Girls	0 (-0.3-0.3)	0.713	+0.2 (-0.2-0.4)	0.639	0.663
Folate (μg)	Boys	+27 (-26-84)	0.088	+32 (-2-63)	0.001	0.356
	Girls	-6 (-26-29)	0.767	+23 (-12-63)	0.008	0.020
Vitamin C (mg)	Boys	-1.7 (-16-41)	0.422	+11.7 (-15-55)	0.112	0.559
	Girls	-1.5 (-34-27)	0.898	+11.2 (-13-33)	0.257	0.465
Vitamin E (mg)	Boys	+0.3 (-2-2)	0.544	+2.4 (0.1-4)	0.006	0.064
	Girls	+0.1 (-1.5-1.4)	0.661	+0.4 (-1.1-3)	0.180	0.383

*Mann Whitney test of differences of changes between intervention and control group
** Wilcoxon signed rank test of differences within groups

12.7 Percentage of boys and girls in the intervention and control group meeting the Reference Nutrient Intake for selected vitamins at baseline (T0) and post-intervention (T1)

Figure 12-2 Percentage of boys in the intervention and control group meeting the Reference Nutrient Intake (RNI) for selected vitamins at baseline (T0)

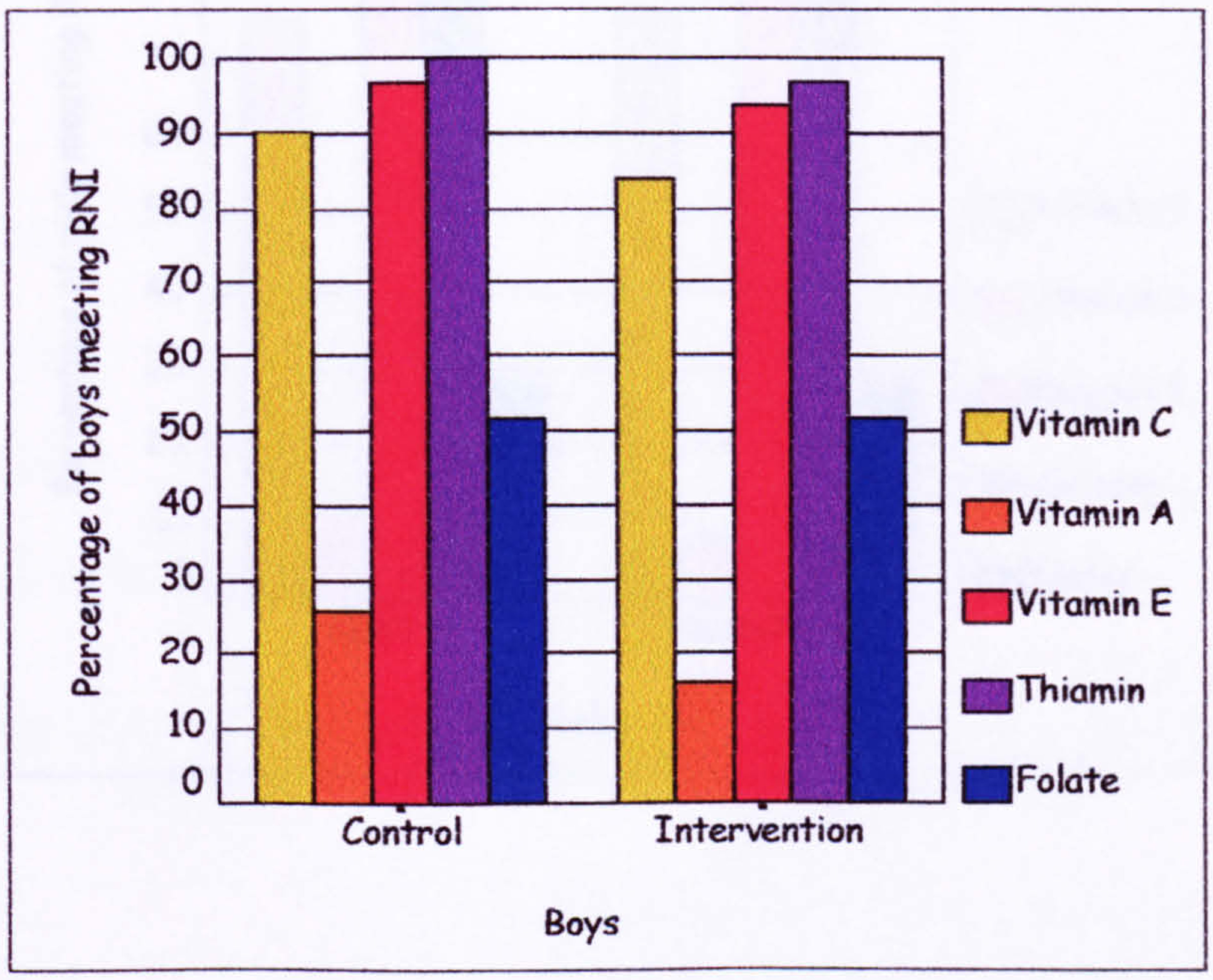


Figure 12-3 Percentage of boys in the intervention and control group meeting the Reference Nutrient Intake (RNI) for selected vitamins at post-intervention (T1)

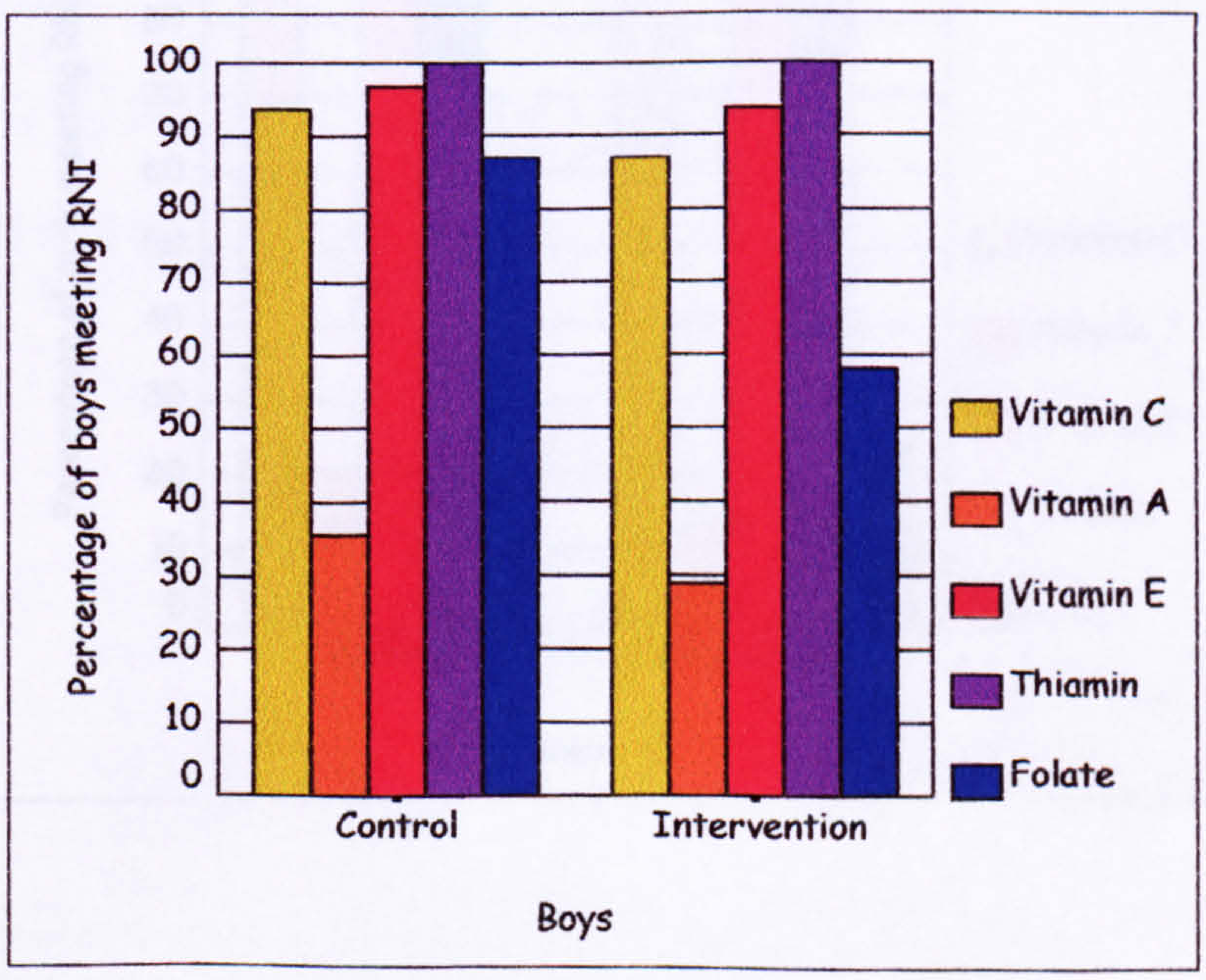


Figure 12-4 Percentage of girls in the intervention and control group meeting the Reference Nutrient Intake (RNI) for selected vitamins at baseline (T0)

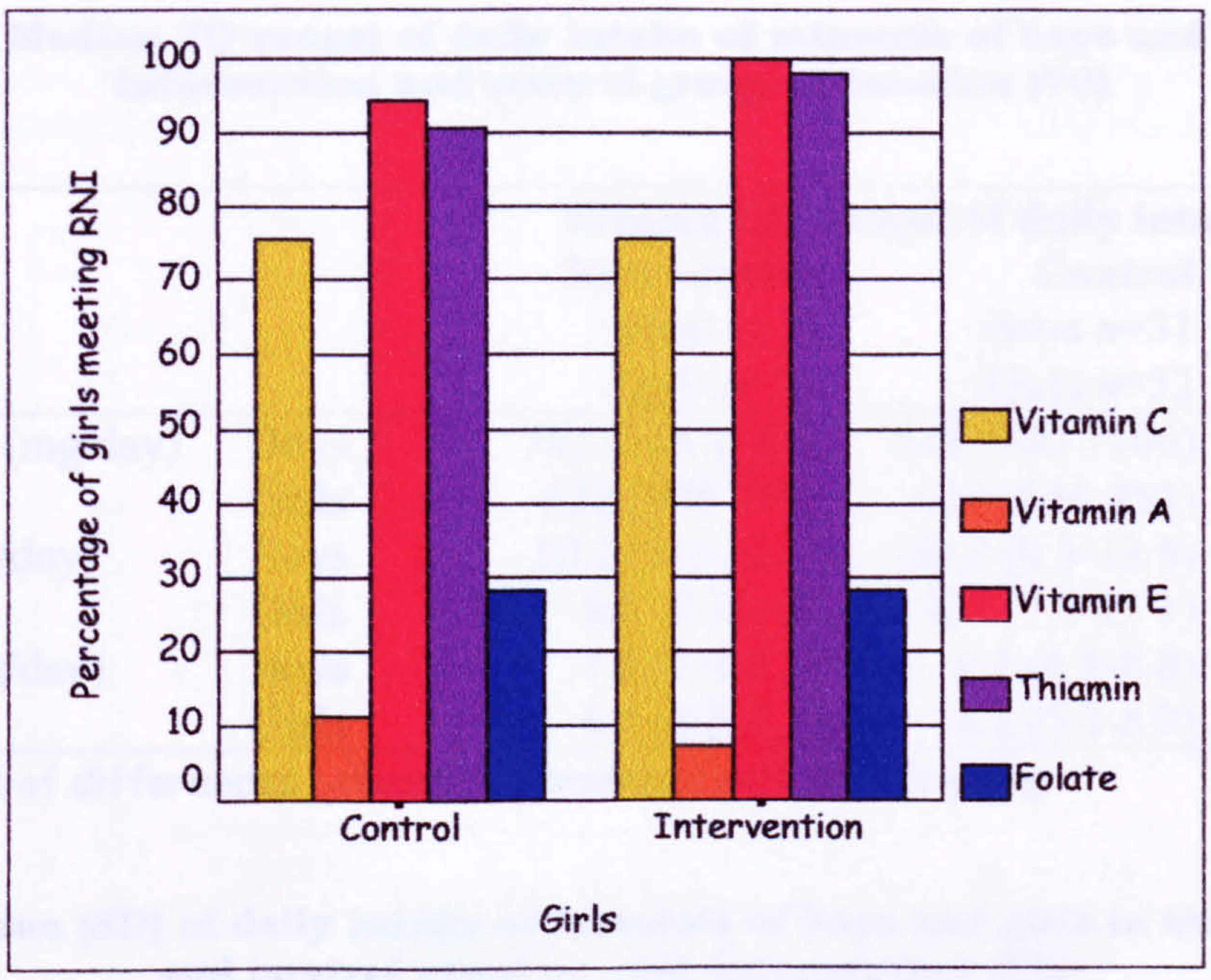
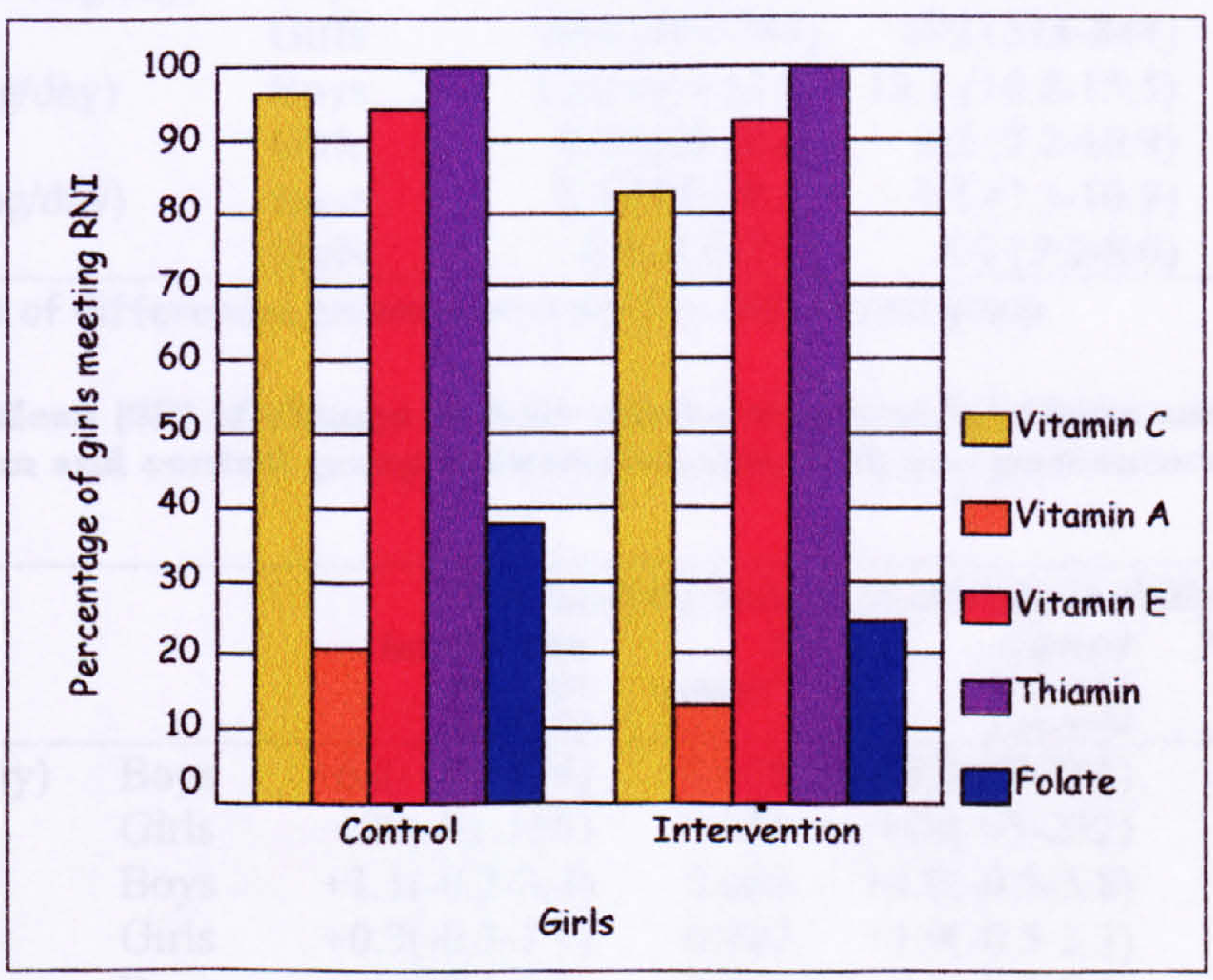


Figure 12-5 Percentage of girls in the intervention and control group meeting the Reference Nutrient Intake (RNI) for selected vitamins at post-intervention (T1)



12.8 Intake of selected minerals by boys and girls in the intervention group and control group at T0, T1 and T1-T0

Table 12.7 Median (IQ range) of daily intake of minerals of boys and girls in the intervention and control group at baseline (T0)

Mineral		Median (IQ range) of daily intake Intervention Boys n=31 Girls n=53	Control Boys n=31 Girls n=52	P value*
Calcium (mg/day)	Boys	782 (586-1087)	918 (740-1106)	0218
	Girls	622 (506-727)	610 (454-752)	0.722
Iron (mg/day)	Boys	10.1 (8.2-13.3)	10.2 (9.3-13.6)	0.597
	Girls	8.6 (7.3-9.7)	8.3 (7.1-12.1)	0.773
Zinc (mg/day)	Boys	7.0 (5.8-9.2)	6.7 (6.1-8.8)	0.894
	Girls	6.4 (4.5-7.5)	6.2 (5.2-8.0)	0.885

* t-test of differences between intervention and control group

Table 12.8 Mean (SD) of daily intake of minerals of boys and girls in the intervention and control group at post-intervention (T1)

Mineral		Median (IQ range) of daily intake Intervention Boys n=31 Girls n=53	Control Boys n=31 Girls n=52	P value*
Calcium (mg/day)	Boys	809 (632-1039)	951 (759-1178)	0.048
	Girls	664 (487-784)	692 (524-844)	0.204
Iron (mg/day)	Boys	12.0 (9.4-13.8)	12.1 (10.8-15.5)	0.240
	Girls	8.3 (6.9-10.4)	9.2 (7.2-10.9)	0.299
Zinc (mg/day)	Boys	8.1 (7.0-10.2)	9.1 (7.3-10.9)	0.443
	Girls	6.4 (4.5-7.5)	6.2 (5.2-8.0)	0.712

* t-test of differences between intervention and control group

Table 12.9 Mean (SE) of change in daily intake of minerals of boys and girls in the intervention and control group between baseline (T0) and post-intervention (T1)

Mineral		Median (IQ range) of change in daily intake Intervention Boys n=31 Girls n=53	P value**	Control Boys n=31 Girls n=52	P value**	P value*
Calcium (mg/day)	Boys	+64(-156-229)	0.108	+152(-75-225)	0.349	0.335
	Girls	+29(-91-156)	0.835	+48(-95-252)	0.077	0.238
Iron (mg/day)	Boys	+1.1(-0.2-3.3)	0.003	+1.9(-0.5-3.8)	0.164	0.328
	Girls	+0.3(-0.3-1.9)	0.947	+1.9(-0.5-2.3)	0.040	0.164
Zinc (mg/day)	Boys	+1.0(0.1-2.9)	0.005	+1.1(-0.1-2.5)	0.005	0.978
	Girls	+0.4(-0.2-0.2)	0.328	+0.2(-0.3-0.3)	0.138	0.855

* Mann Whitney test of differences in changes between intervention and control group

* Wilcoxon signed rank test of differences within groups

12.9 Percentage of children in the intervention and control group meeting the Reference Nutrient Intake for calcium, iron and zinc at baseline (T0) and post-intervention (T1)

Figure 12-6 Percentage of children in the intervention and control group meeting the Reference Nutrient Intake (RNI) for selected minerals at baseline (T0)

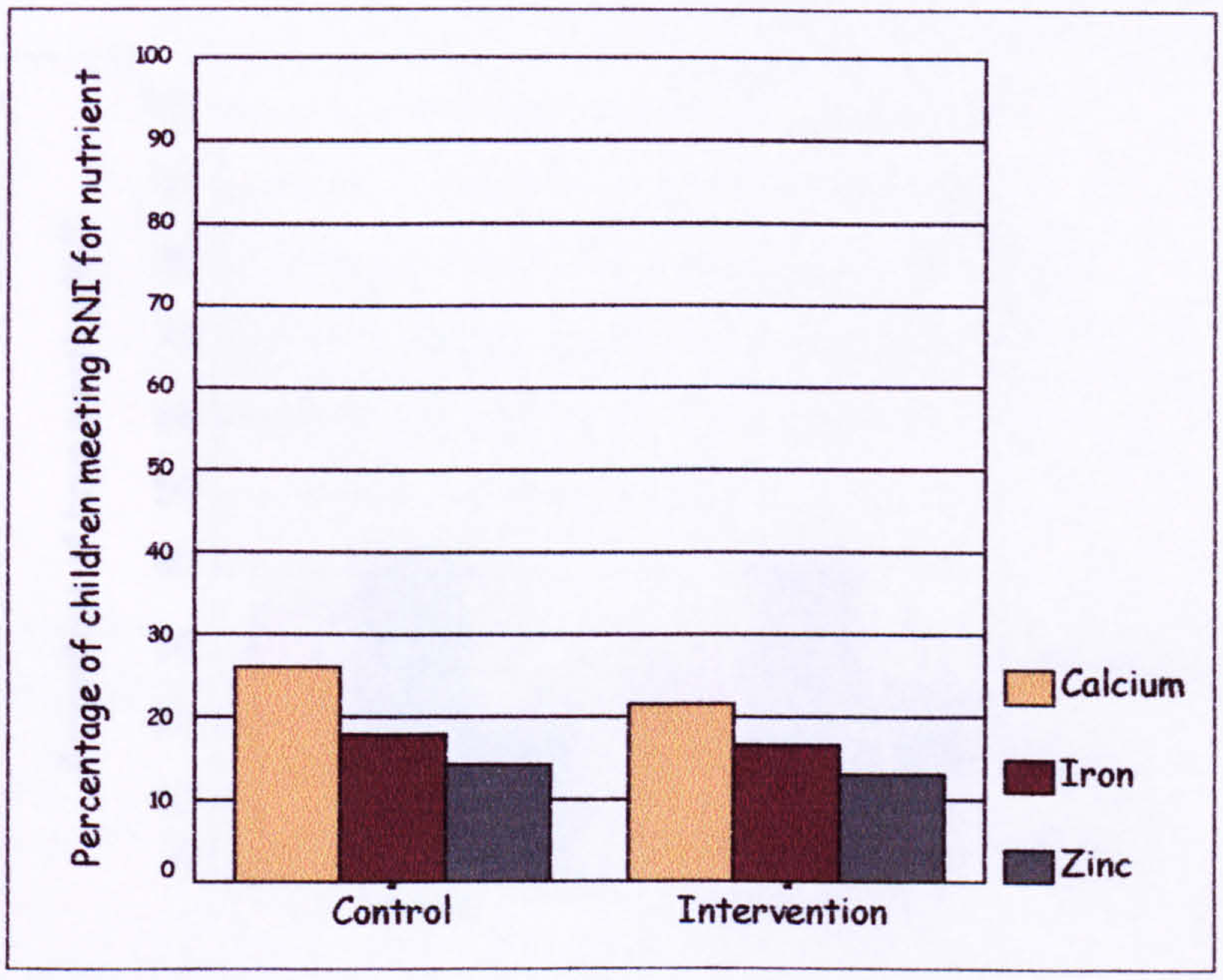
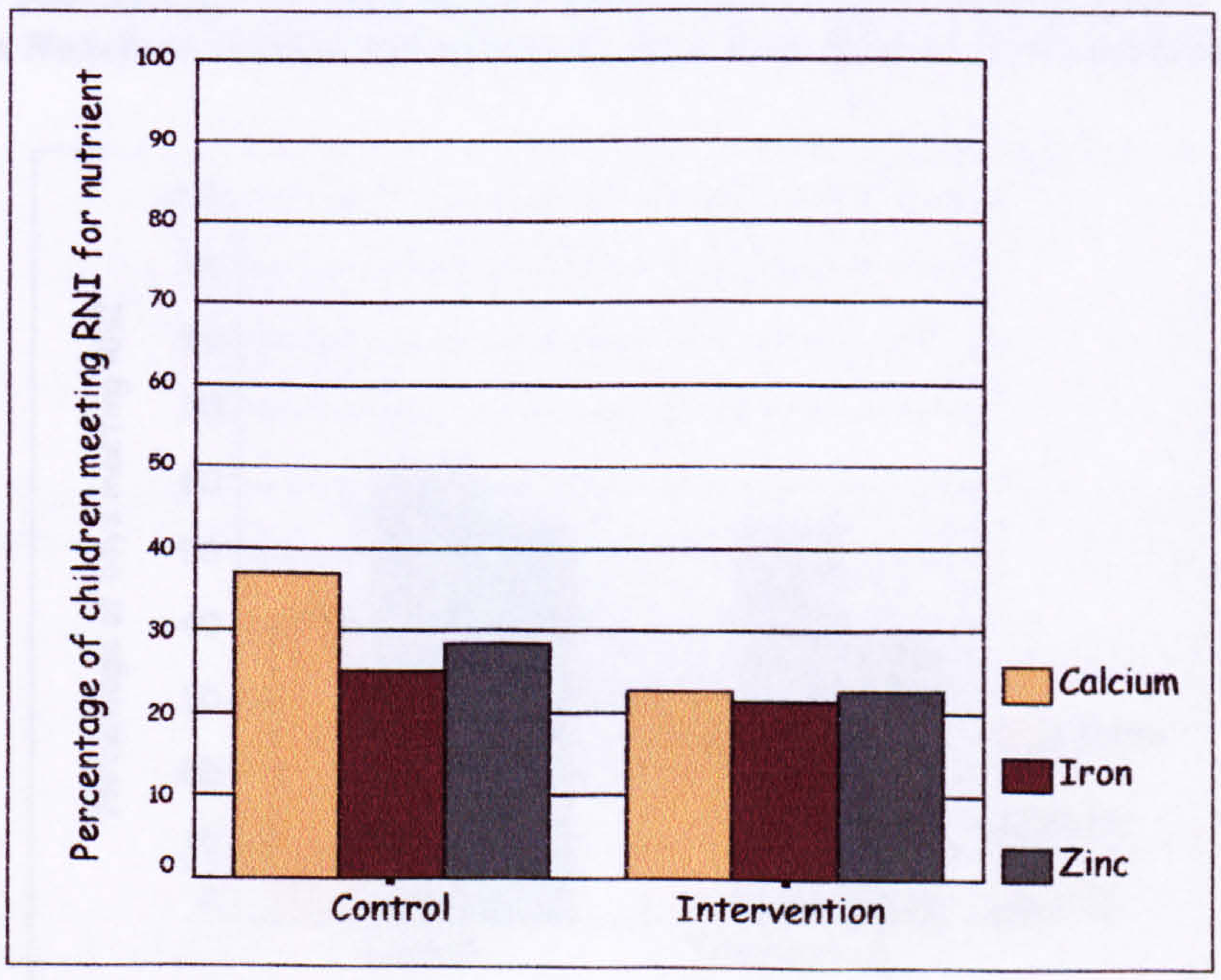


Figure 12-7 Percentage of children in the intervention and control group meeting the Reference Nutrient Intake (RNI) for selected minerals at post-intervention (T1)



12.10 Percentage of boys and girls in intervention and control groups meeting Reference Nutrient Intake for calcium, iron and zinc at baseline (T0) and post-intervention (T1)

Figure 12-8 Percentage of boys in the intervention and control group meeting the Reference Nutrient Intake for calcium, iron and zinc at baseline (T0)

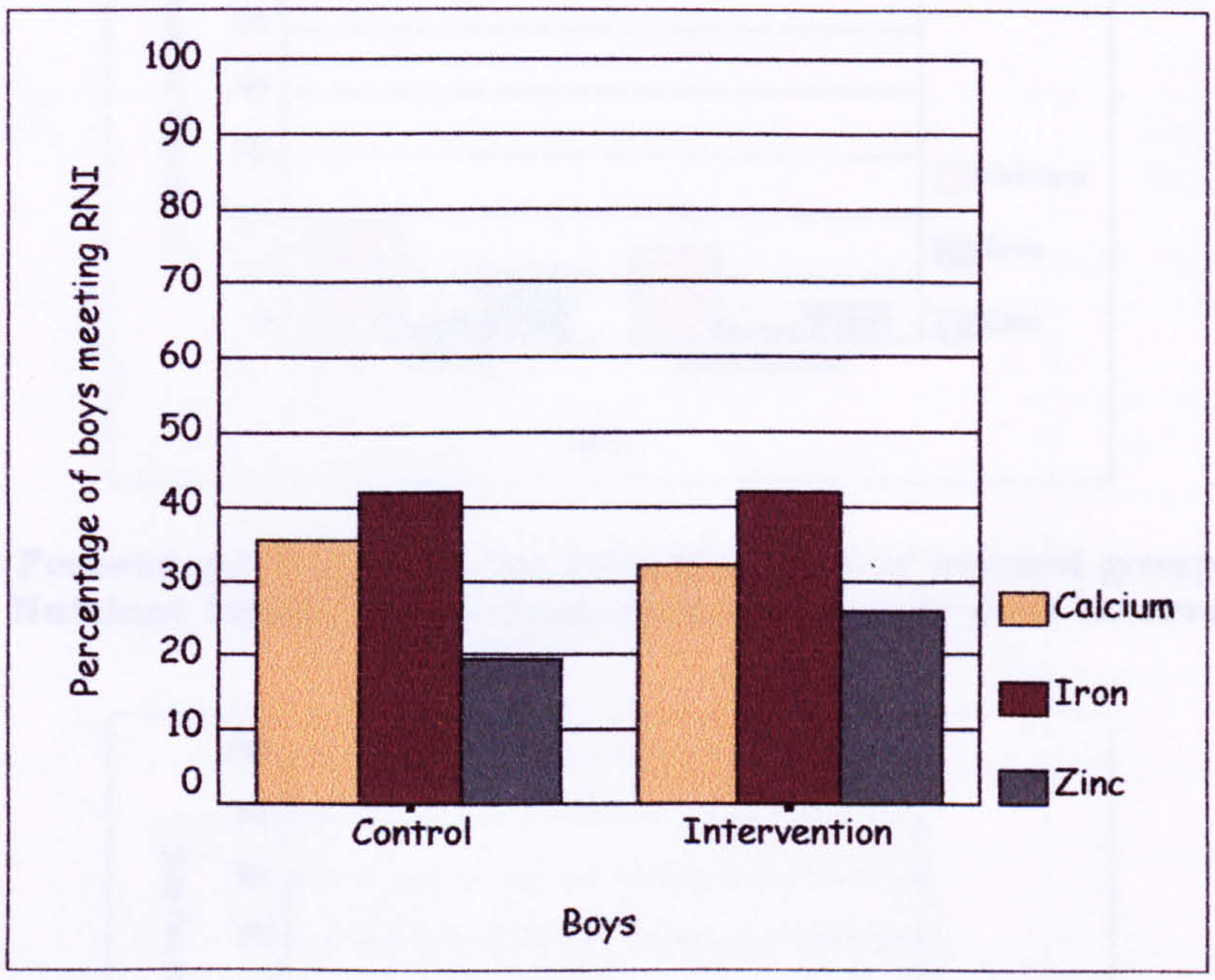


Figure 12-9 Percentage of boys in the intervention and control group meeting the Reference Nutrient Intake for calcium, iron and zinc at post-intervention (T1)

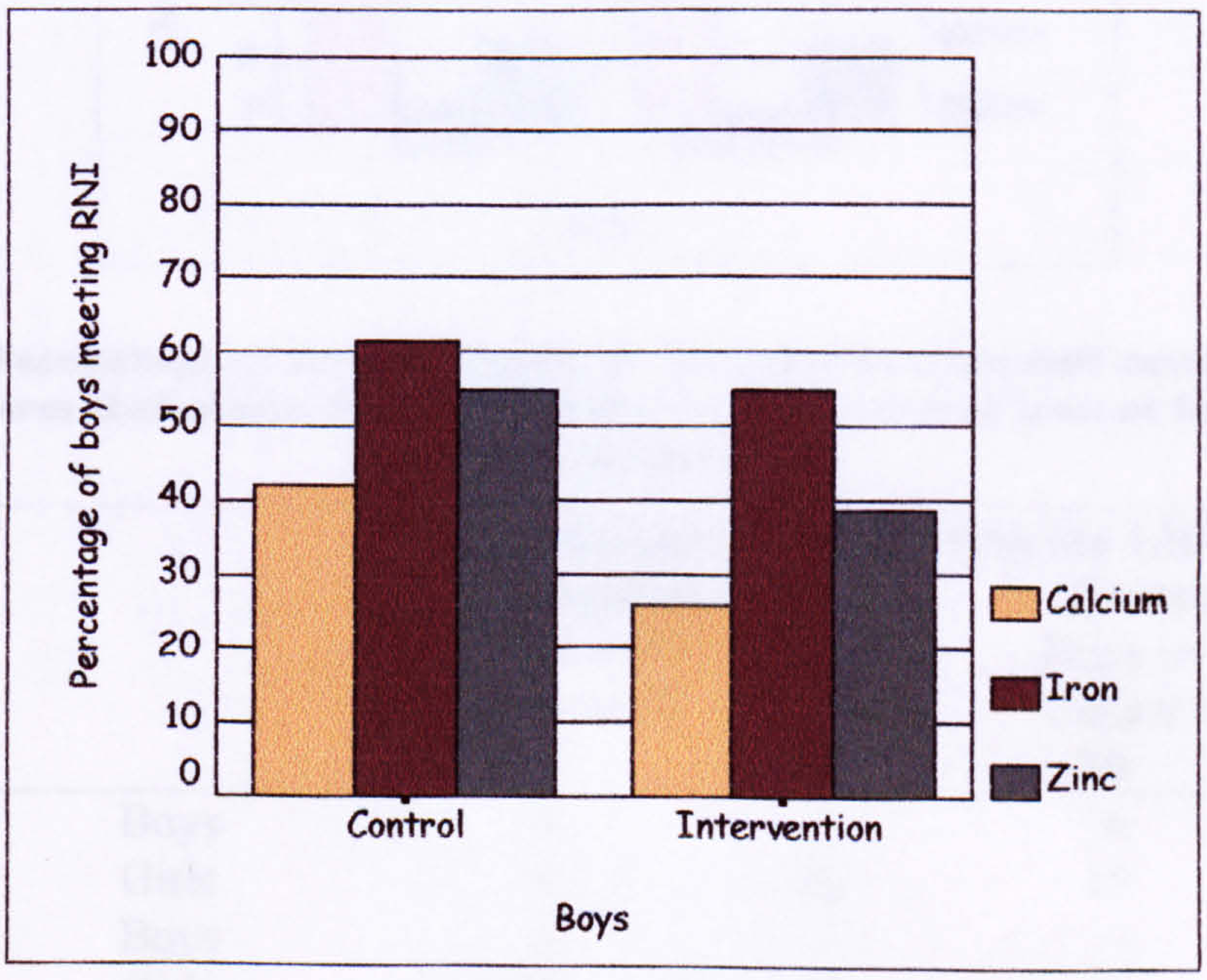


Figure 12-10 Percentage of girls in the intervention and control group meeting the Reference Nutrient Intake for calcium, iron and zinc at baseline (T0)

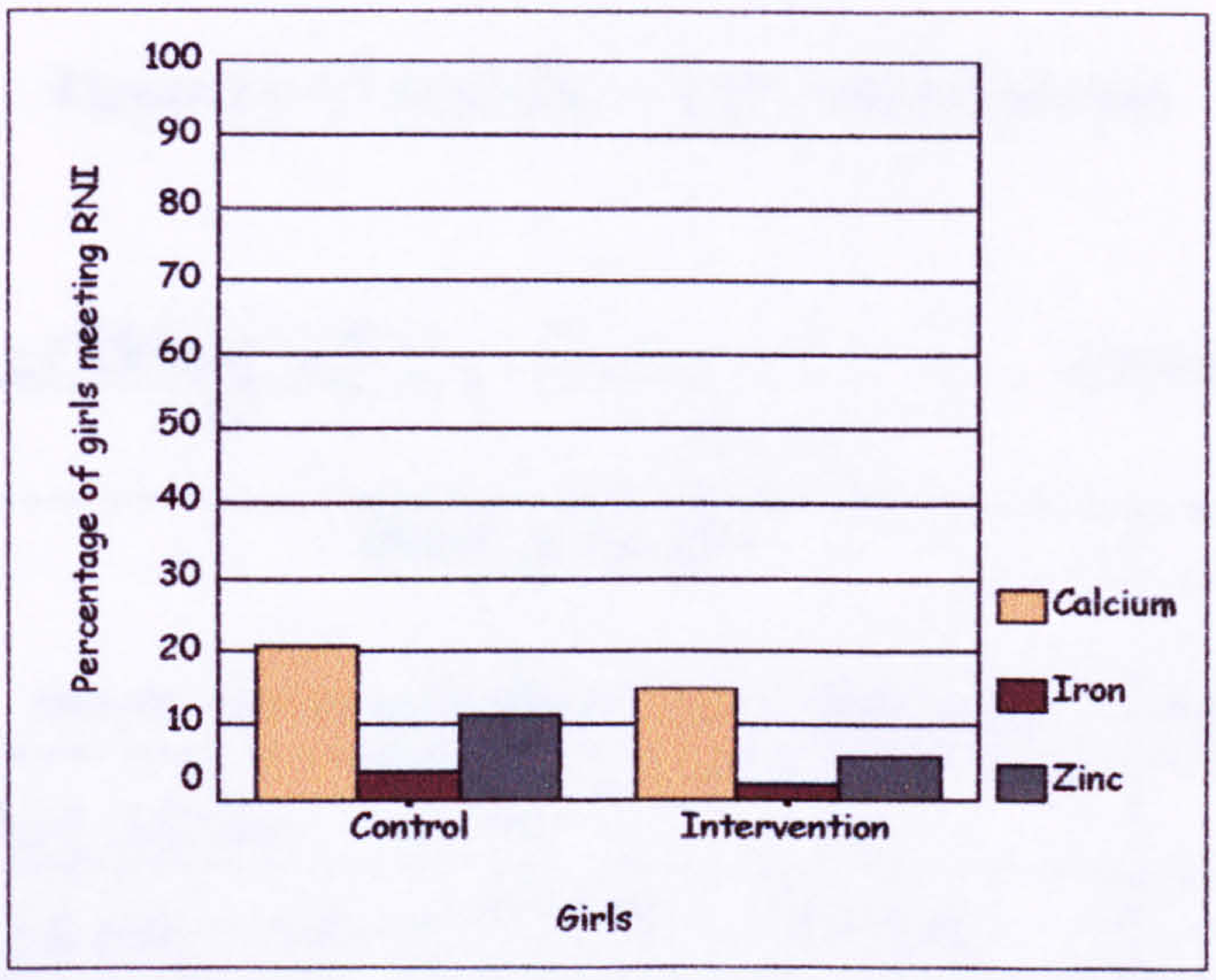


Figure 12-11 Percentage of girls in the intervention and control group meeting the Reference Nutrient Intake for calcium, iron and zinc at post-intervention (T1)

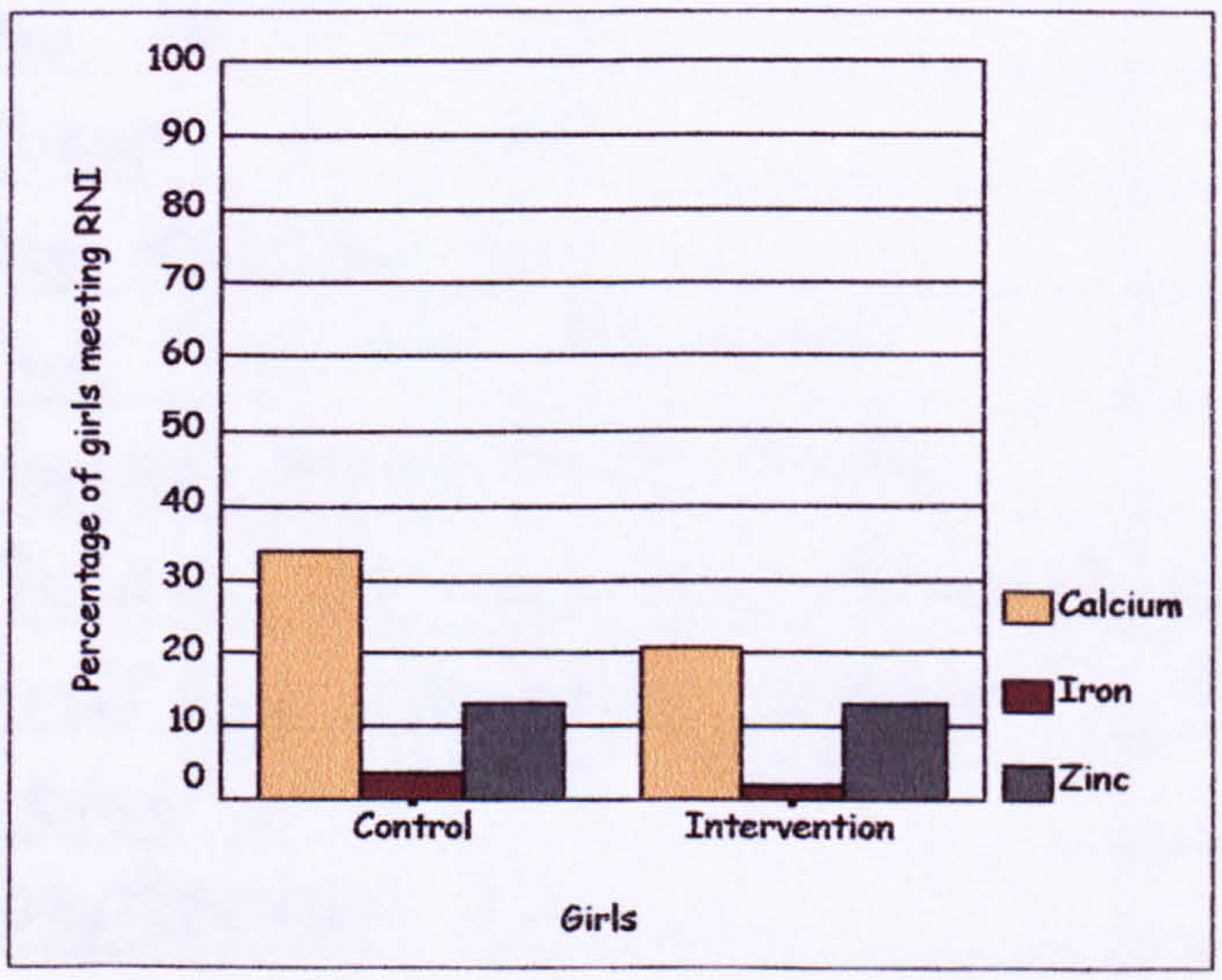


Table 12.10 Percentage of boys and girls in the intervention and control group not meeting the Lower Reference Nutrient Intake for calcium and iron at baseline (T0) and post-intervention (T1)

RNI		% of children not meeting the LRNI			
		Intervention Boys n=31 Girls n=52		Control Boys n=31 Girls n=52	
		T0	T1	T0	T1
Calcium	Boys	3	-	6	-
	Girls	6	10	15	9
Iron	Boys	-	-	-	-
	Girls	41	41	42	28

12.11 Examples of food diary completion by children taking part in The Good Food Study

Figure 12-12 Example 1 (Girl, control group)

Day Saturday 15th July

Start each day

Time of Day	Food & Drink Include: Brand name, flavour and packet weight	Cooking method e.g. fried, grilled
9:10	Nestlé Cheerios	
"	Semi-skimmed Milk	
10:25	Aro Coke	
"	~~Mini Coffees~~ Pickled Onion Space Raiders	
10:45	Mini Refresher bar	
"	Mixup (10 sweets)	
1:15	Big Refresher bar	
3:30	Fruit Pastilles (Rowntrees)	
5:15	Yoplait Forest Fruits Frube	
7:05	McCains Stringfellows (chips)	oven
"	Birds Eye Chicken Chargrills	oven
"	Semi-skimmed Milk	
8:35	Raspberries fresh	

* I was at dancing so I needed a lot of sweets for stamina.

Figure 12-13 Example 2 (Girl, control group)

Day 17·7·00 Start each day on a new sheet

Time of Day	Food & Drink Include: Brand name, flavour and packet weight	Cooking method e.g. fried, grilled	Amount Eaten e.g. cup, slice, tsp, bowl, portion of family meal	Bought from home, shop school
8·00am	Kelloggs branflakes	–	60grams	home
"	Semi-skimmed milk	–	125ml	"
8·10am	Wholemeal (Hovis) Toast	Toasted	2 slices	"
"	Flora light, Strawberry Jam	–	?	"
12:25pm	White large bun	–	1, large	"
"	Bernard Mathews 95% fat free Turkey	–	2 slices	"
"	Be good to yourself 95% fat free chocolate cup cake	–	1 cake	"
"	Honeydew Melon	–	1 medium slice	"
4pm	Rich tea biscuits (McVities)	–	2 biscuits	"
6.30pm	Pepper (Green)	–	1slice	"
"	Cucumber	–	1 large slice	"
"	Lettuce (Iceburg)	–	1 cup	"
"	Seafood Sause (95% ff)	–	1 flat tbsp	"
"	Wholemeal (Hovis) bread	–	1slice	"
6·55pm	McVities rich tea biscuits	–	2 biscuits	"
8·10pm	Honeydew melon	–	1 XL slice	"
12·25	Ribena + Lemonade (Diet)	–	1small glass	"

Figure 12-14 Example 3 (boy, intervention group)

Day Sunday

Start each day

Time of Day	Food & Drink Include: Brand name, flavour and packet weight	Cooking method e.g. fried, grilled
01:20pm	Weetabix ~~x~~ with full fat milk	
2:55pm	Robinsons Orange Juice	
3:05pm	Nectarine	
3:40pm	Twix	
3:50pm	Fab	
5:30pm	Sunday dinner (yorkshire pudding, mince, brocoli, potatoe)	Oven baked
5:40pm	Strawberrys	
6:05pm	Banana	
6:30	Apple (Granny Smith)	
6:35	Nectarine	
7:10	Nectarine	
7:15	Wotsits	
8:50	Apple	
9:15	White Toast	Toasted
9:15	White Toast	Toasted
9:15	Robinsons Orange Juice	

12.12 Determination of P-aminobenzoic acid

Method

The method employed was that of Bingham & Cummings (1982) to determine p-aminobenzoic acid as a biochemical marker for completeness of 24-hr urine collections. This method requires prior alkaline hydrolysis of the analyte since it is known to be excreted mostly as the acetylated metabolite at the given dosage (Bingham & Cummings, 1985). Following hydrolysis the analyte will form a diazonium salt with Napthylene diamine dihydrochloride the absorbance of which may be read at 540nm.

Preparation of standards

240mg of PABA standard were accurately weighed into a weighing boat. De-ionised water was used to transfer the standard into a 1L volumetric flask and further washings added to the flask. Following the addition of six NaOH pellets the flask was then made up to 1L with de-ionised water to provide an initial concentration of 240mg PABA/L. The flask was then sealed and left for a minimum of six hours to allow the PABA to fully dissolve.

PABA standards were prepared at concentrations of 60mg/L, 120mg/L, 180mg/L and 240mg/L.

Materials

1M Sodium Hydroxide: - 40g of NaOH pellets were accurately weighed onto a weighing boat and transferred to a 1L volumetric flask. Approximately 100ml of de-ionised water were added and the flask gently rotated to facilitate dissolution. The contents of the flask then made up to 1 litre with de-ionised water.

Napthylene Ethylenediamine Dihydrochloride: - 1g of Napthylene ethylenediamine dihydrochloride was accurately weighed into a weighing boat and transferred with de-ionised water to a 1L volumetric flask. After gentle rotation to facilitate dissolution the flask was made up to 1L. The solution was then transferred to a dark glass storage bottle and placed in the refrigerator (at 1°C) until required.

Sodium Nitrite: - 100mg of sodium nitrite powder were accurately weighed onto a weighing boat. The powder was transferred with de-ionised water into a 100ml volumetric flask and made up to the mark with de-ionised water to give a concentration of 1mg $NaNO_3$/ml.

Ammonium Sulphate: - 500mg of ammonium sulphamate were accurately weighed into a weighing boat. The powder was transferred with de-ionised water into a 100ml volumetric flask and made to the mark with de-ionised water to give a concentration of 5mg NH_4SO_3.

Procedure

The frozen samples were allowed to thaw completely overnight at refrigeration temperature. 0.1ml aliquots of tests, standards and blanks were prepared in duplicate and placed in ?? tubes. 10ml of 1M NaOH was added to each tube, which were then capped and thoroughly mixed. Test and blank samples were placed in a boiling water-bath for two hours and standards were refrigerated at 1°C. Following removal from the water-bath the test and blank samples were allowed to cool to room temperature. 3ml of 5M HCl was added to each tube and mixed.

At two-minute intervals, with thorough mixing after each addition, 1ml of sodium nitrate, 1ml of ammonium sulphamate, and 1ml of napthylene ethylenediamine dihydrochloride were added in respective order and all samples allowed to stand at room temperature for one hour to allow the colour to develop. The absorbance was read at 540nm using a Unicam 100 UV/Vis Spectrometer. The absorbance values obtained for duplicate standard were entered onto an Excel spreadsheet and used to construct a calibration curve and calculate both the linear regression (r^2) and straight line equation ($y = mx + c$) for each of the three separate experimental runs.

Figure 12-15 PABA Standard Calibration Curve (Series 1)

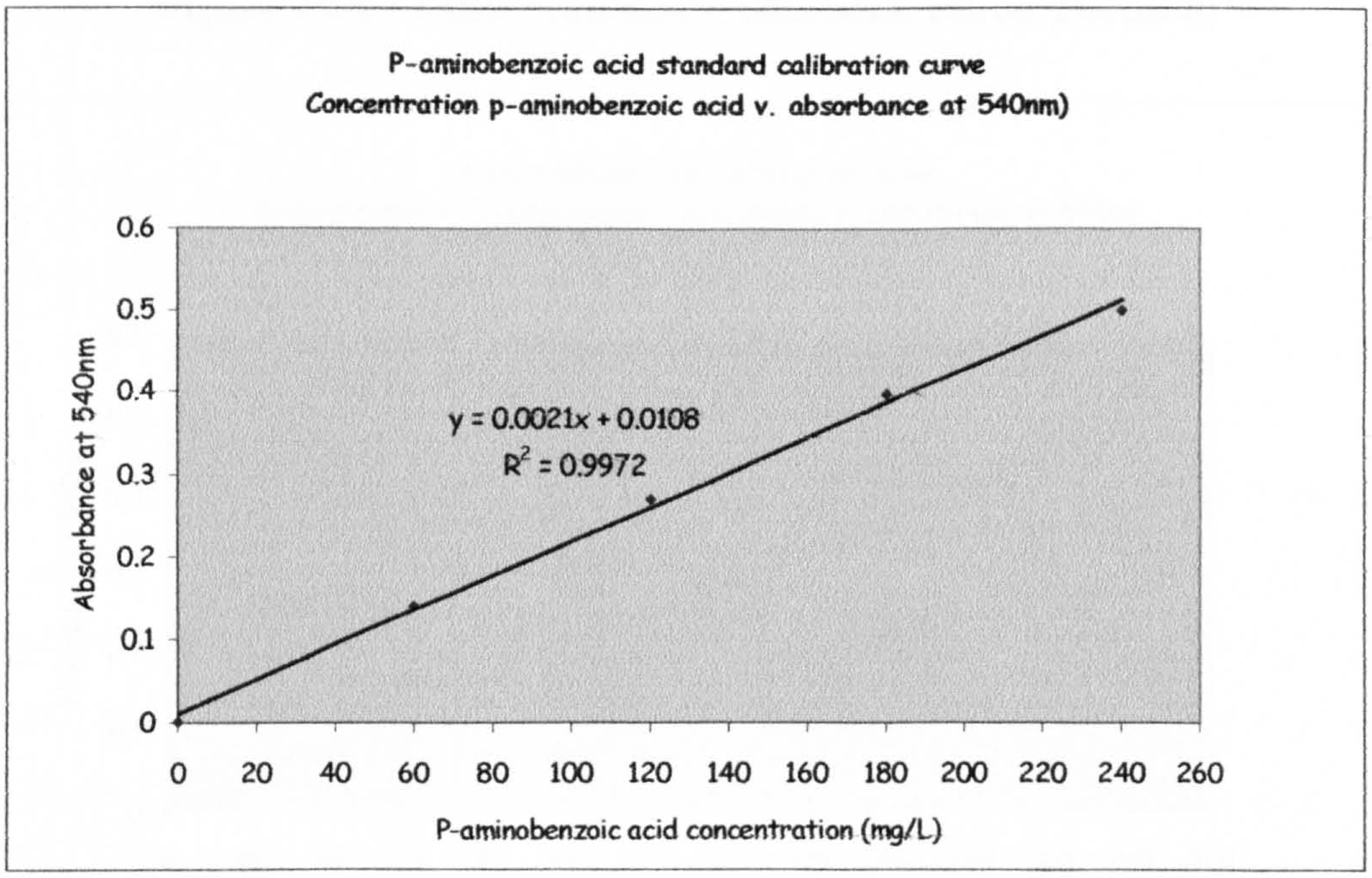


Figure 12-16 PABA Standard Calibration Curve (Series 2)

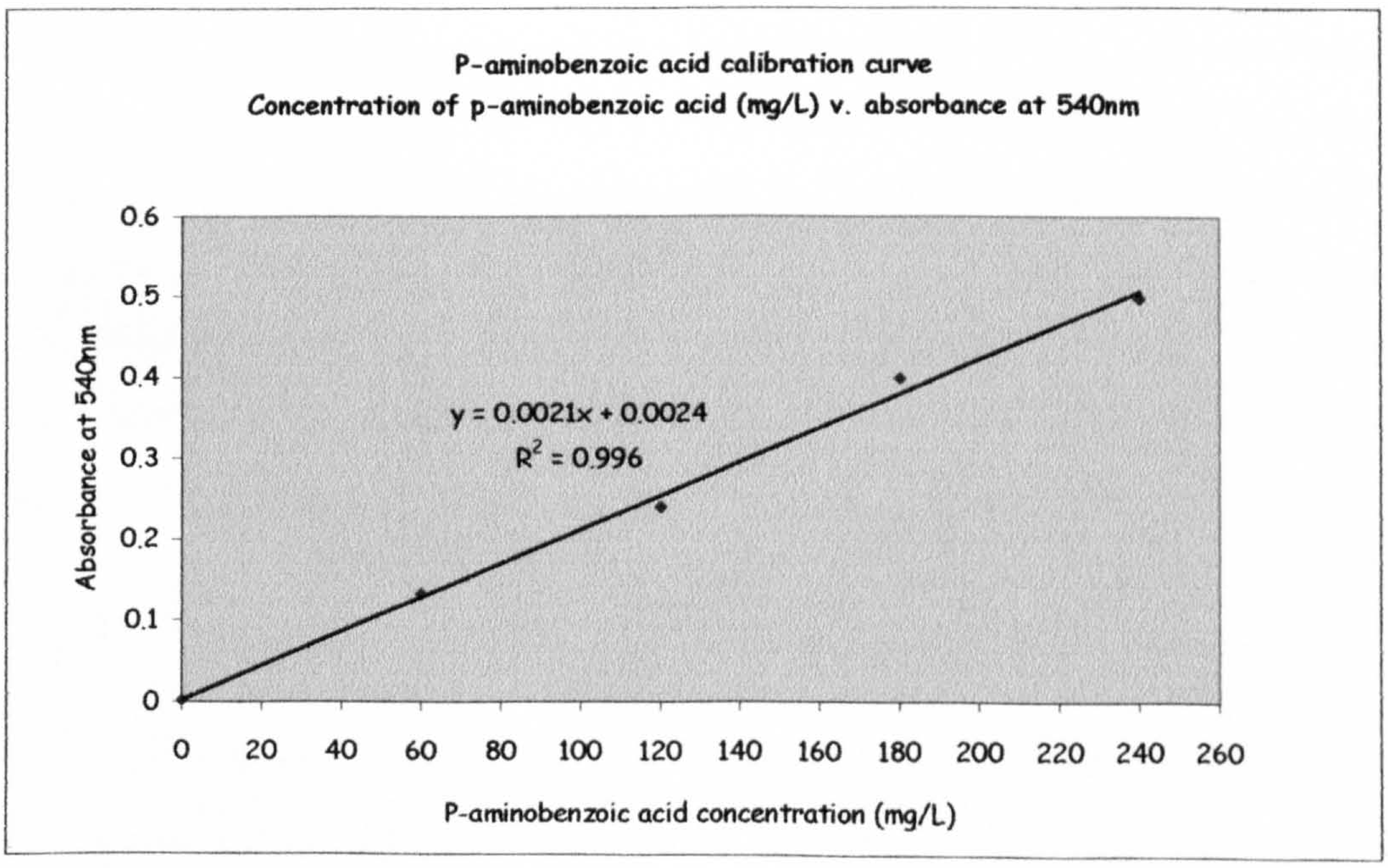
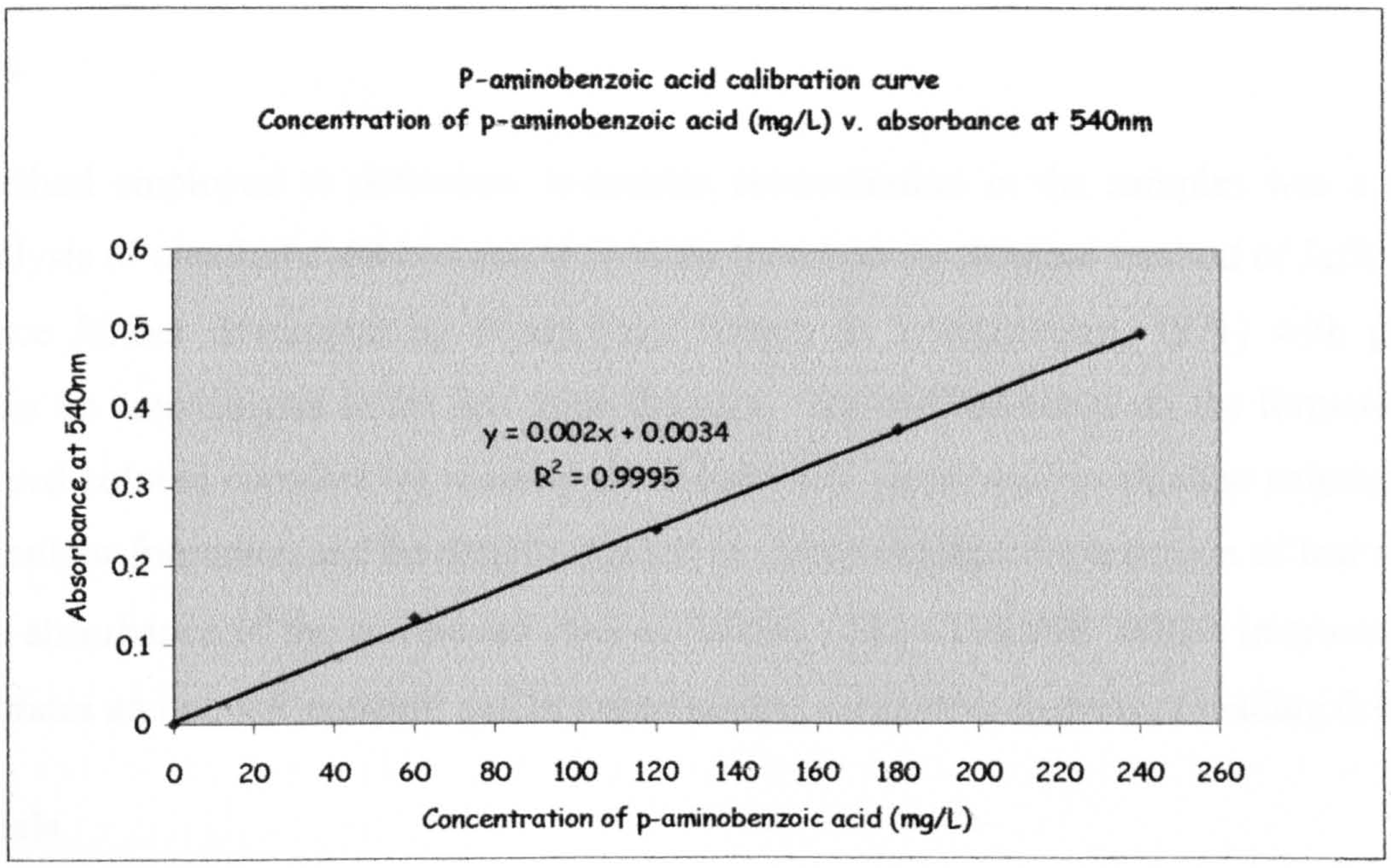


Figure 12-17 PABA Standard Calibration Curve (Series 3)



12.13 Determination of 24-hr urinaeytinine by COBAS® MIRA Autoanalysis

Method

The method employed to determine creatinine concentration in the samples was a routine autoanalysis of creatinine determination in urine based on the original method of Jaffé (1886) and since further developed by others (e.g. Fabiny & Ertinghausen, 1971) with growing emphasis on autoanalysis in the last three decades. The method relies on the formation of a yellow-red colored complex by reacting creatinine with picric acid in alkaline solution. The rate of colour formation can be directly related to the creatinine concentration of test samples and the absorbance of the compound read at 500nm. The COBAS® MIRA instrumentation incorporates an internal standard and between sample calibration to prevent reading drift.

Materials

Creatinine standards, solutions and working reagents for COBAS® MIRA application were obtained from Uni-Kit (Roche) Kit No. Art 07 1115 2.

Procedure

Samples required pre-dilution prior to assay to the order 1:100 (1 + 100) with de-ionised water. 50µL of thawed test sample was added to 5ml of de-ionised water and thoroughly shaken. From this 100µL of test samples were placed into the COBAS® MIRA unit, mixed with 1000µL of working reagent and brought to a temperature of 25°C. After 30 seconds the absorbance is read automatically A_1 and again after a further 2 minutes A_2 to give the value ΔA. The concentration of creatinine in the test sample was quantified instrumentally by the equation

$$\frac{\Delta A(T)}{\Delta A(C)}\, x[C]$$

where C is the calibrator. For urinary creatinine the result is multiplied by 100 to give a creatinine concentration of mg/100ml.To calculate creatinine coefficient (mg/kg/24hr) = $\frac{\text{urinary creatinine(mg/24-hour)}}{\text{body weight (kg)}}$

12.14 Determination of urinary nitrugimg LECO® Autoanalysis

Method

The method of determining urea nitrogen employs the hydrolysis of urea to ammonium carbonate by urease. The ammonia released for the carbonate by the addition of alkali will react with phenol and sodium hypochlorite in the presence of a catalyst, sodium nitrogprusside, in an alkaline medium to form a blue coloured indophenol. The intensity of the blue colour is proportional to the quantity of urea in the urine and the absorbance of the blue complex can be measured photometrically at 560nm.

Procedure

Urine samples were diluted with de-ionised to the order of 1:25 and placed into the LECO® analyser for further processing. The nitrogen content of the sample was taken directly from instrumentation output and expressed as %N per 100ml.

Urea nitrogen of the total urine collection was calculated thus:

$$\frac{\%N(V)}{d}$$

where V is total volume of 24hr urine and d the dilution factor (100)

12.15 Determination of urinary potasind sodium in 24-hr urine samples using Emission Flame Photometry

Method

Some mineral elements have the capacity to give off radiation that appears to be coloured and this may be demonstrated in by the simple technique of holding a dilute solution in the heat of a flame. When the heat source is intensified, heat energy, for example that provided by a gas-air flame in a photometer, can cause excitation in electrons of known mineral atoms and can raise these electrons from the ground state to the excited state. If the electron looses energy and drops back down to the ground state from its excited level in one singular jump, the radiation given off is termed the resonance line. However, when electrons loose energy in a series of steps, then some of the energy given off will be in the visible and infra red regions of the spectrum or it may lose energy entirely by radiationless collisions with other electrons. Each metal has a different set of energy levels due to different nuclear charge and a different number of electrons. As such, the wavelengths of emitted radiation will be different for each element and it is possible to measure the position of the these wavelengths within the UV-visible spectrum and this data can be used to identify which atoms are presents. When the intensity of radiation is also measured this enables a quantitative analysis to be performed. Sodium and potassium are alkaline earth metal ions and therefore most suited to analysis using emission flame photometry. The metals are first atomized, subjected to a gas-air flame (between 900-1200°C)and emission from the resulting excitiation of electrons amplified and measured.

Materials

Sodium and potassium chloride were used in the preparation of standards as chloride ions would not effect the analysis. De-ionised water of high purity was used in the preparation of standards and in the dilution of samples (resistance > 1,000,000 ohms).

Preparation of potassium standards

Standards were prepared from chloride salts by accurately weighing 1g of potassium/sodium chloride and transferring into a 1L volumetric flask. De-ionised water was added and made up to the mark. The solution was fully dissolved with the use of a magnetic flea for approximately 20 minutes. The solution (1g/L) was then further diluted and standards prepared to give concentrations containing 5 μg/ml, 10 μg/ml, 15μg/ml, 20μg/ml and 25μg/ml for potassium standards and 2μg/ml, 4μg/ml, 6μg/ml, 8μg/ml and 10μg/ml for sodium standards. The emission values were plotted versus ion concentration and the straight-line equation $y = mx + c$ determined.

Procedure

Thawed samples were thoroughly shaken and a prepared in a dilution series of 1:100, 1:200 and 1:500 in de-ionised water.

Each dilution was tested in series until an emission value could be obtained within the standard range. The emission of each test sample was recorded only after allowing the reading to settle and correcting for instrumentation drift by resetting to zero with the use of standards after every ten samples.

Table 12.11 Determination of urinary sodium by flame photometry: record of instrumentation drift and proximity to concentration of standard

Concentration of standard (μg/ml)	[Na] at baseline	[Na] at Test #10	[Na] at Test #20	[Na] at Test #30
0μg/ml	0	0	0	0
5μg/ml	8.2	8.3	7.8	7.4
10μg/ml	14.1	13.7	13.4	13.8
15μg/ml	19	18	18.5	18.1
20μg/ml	22.3	22.4	22.1	21.7
25μg/ml	26.5	27	26.5	25.2

Table 12.12 Determination of urinary potassium by flame photometry: record of instrumentation drift and proximity to concentration of standard

Concentration of standard (μg/ml)	[K] at baseline	[K] at Test #10	[K] at Test #20	[K] at Test #30
0μg/ml	0	0	0	0
5μg/ml	1.8	1.8	1.8	1.7
15μg/ml	4	4.1	4	4
20μg/ml	6.5	6.6	6.5	6.5
25μg/ml	9.3	9.3	9.3	9.3
30μg/ml	10	10	10.1	10.1

Figure 12-18 Sodium Standard (Baseline) Calibration Curve

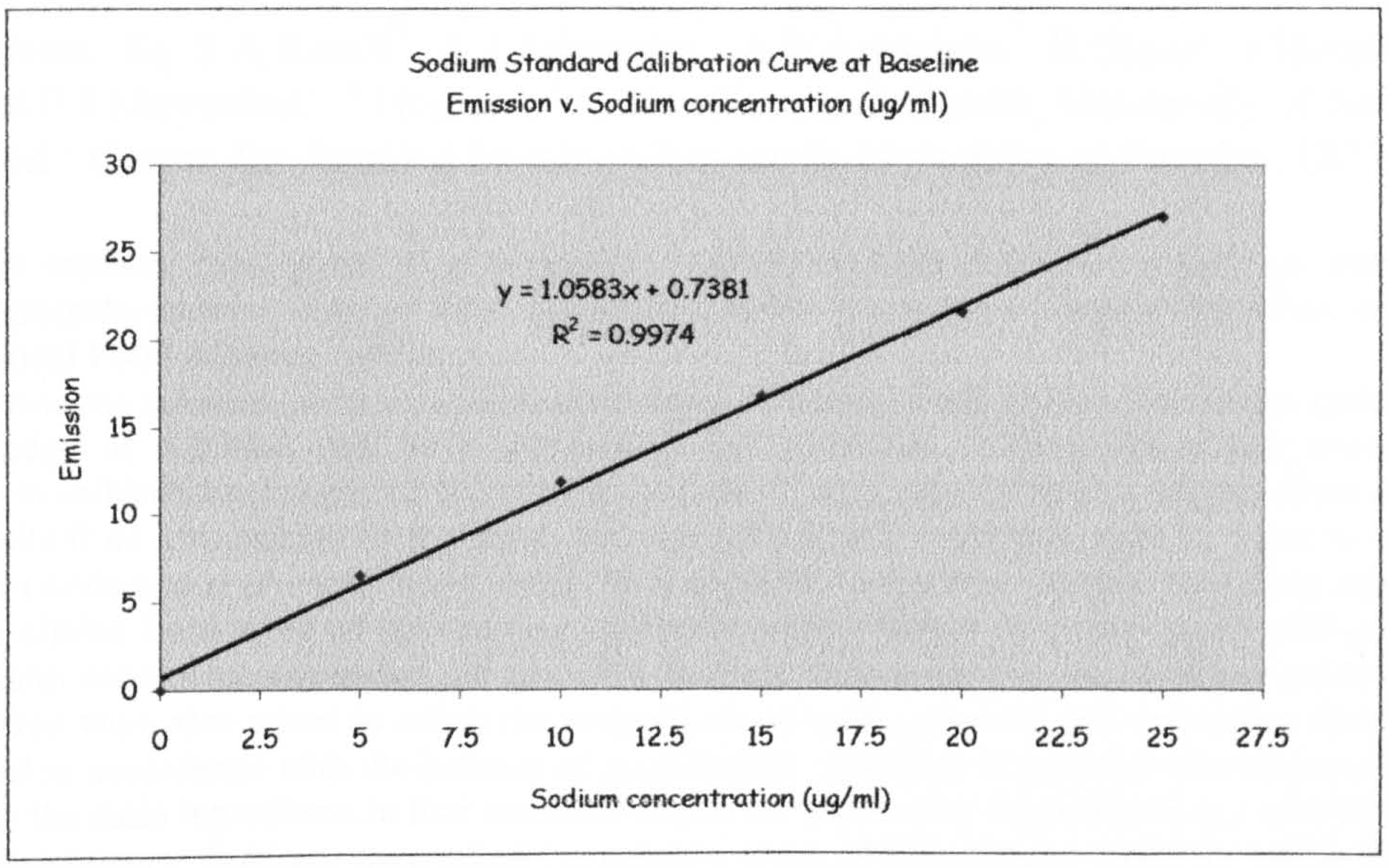
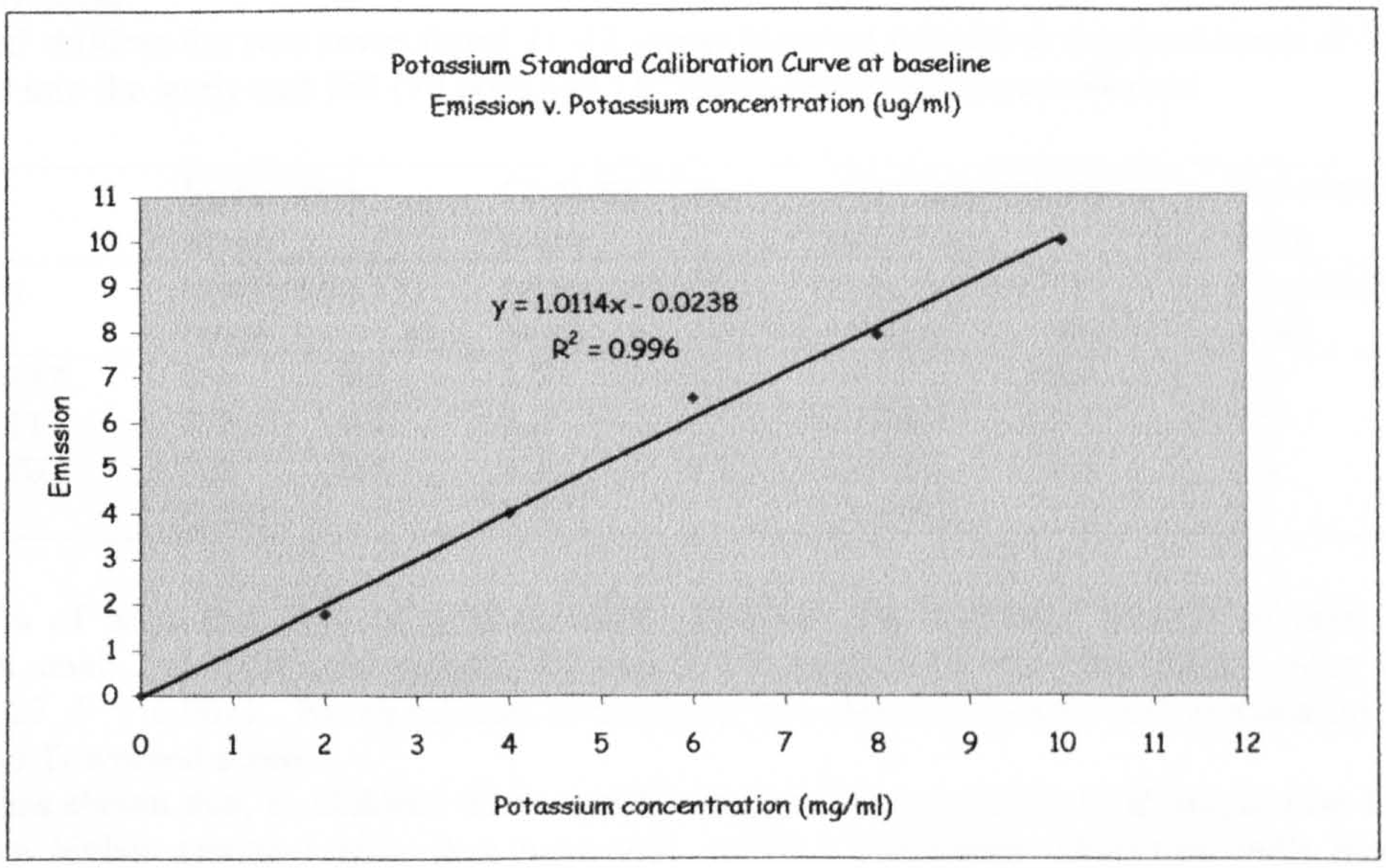


Figure 12-19 Potassium Standard (Baseline) Calibration Curve at baseline



12.16 Nutritional knowledge, food patipn knowledge and cooking confidence of 187 schoolchildren

Nutritional Knowledge, food preparation knowledge and cooking confidence of 187 schoolchildren. By S.A.Revill[1], A J Adamson[1], A S Anderson[2], R Stacy[1], J Hooper[1], H Taylor[1], and P J Moynihan[1], [1] Human Nutrition Research Centre, University of Newcastle NE1 4LP and [2] Centre for Applied Nutrition Research, University of Dundee, DD1 4HT

The demise in teaching food preparation in schools is likely to have the worst impact on those from lower income backgrounds because lack of food preparation skills has a more detrimental effect on low-income families (National Food Alliance, 1997).

As part of baseline measurements in a controlled study of nutrition education intervention (after-school food club), knowledge of nutrition and food preparation and perceived cooking confidence were assessed by questionnaire in children from deprived social backgrounds. The questionnaire was adapted from one previously applied to adults from low-income backgrounds and was pilot tested in children aged 11 years to ensure validity and reliability (Anderson *et al* unpublished data). Nutrition knowledge was assessed by asking subjects to select the healthiest choice from a list of options (e.g. different potato dishes), and how many portions of fruit and vegetables health experts recommended per day. For each correct answer they received one point (total score 0-8). The children were also asked to select the proportions of meat, potatoes and vegetables that composed the healthiest meal in accordance with the balance of good health. Cooking knowledge was assessed by asking the children to list the main ingredients in four common dishes for which they received a score of 0-15 (one point for each correct ingredient). Subjects were asked the cooking times of five popular foods for which they received a score of 0-5. Cooking confidence was assessed by asking the children if they could make nine specified dishes all by themselves (3 points), with a little help (2 points) with a lot help (1 point) or not at all (0 points). Points were summed to give a cooking confidence score of 0-27. Data were entered into SPSS, mean scores ($\pm$ se) were derived and differences between sexes determined using t-test. Relationship between Townsend Material Deprivation scores (Townsend *et al*, 1987) and nutrition knowledge and cooking scores were determined using Pearson's correlation.

Two hundred children for year seven (aged 11-12 years) from ten schools in deprived areas of Tyne and Wear were recruited into the study and 187 (70 boys and 117 girls) completed the assessment.

	n	Ingredients score (maximum 15)		Cooking times score (maximum 5)		Cooking confidence score (maximum 27)		Nutrition knowledge score (maximum 8)	
		mean	se	mean	se	mean	se	mean	se
All	187	8.4	0.2	1.7	0.1	17.0	0.4	5.3	0.1
Girls	117	9.3	0.3	1.7	0.1	17.8	0.5	5.5	0.2
Boys	70	7.0	0.3	1.7	0.1	15.8	0.8	5.0	0.2
P value		0.001		0.8		0.400		0.1	

Overall 64% of boys and 69% of girls correctly identified the healthiest balance of meat, potatoes and vegetables. A small, but significant relationship was found between nutrition knowledge score and Townsend score ($r = -0.27$, $P = 0.001$). No significant relationship was found between food preparation knowledge or confidence and Townsend score.

This study has shown that, in children from socially deprived backgrounds, food preparation knowledge and confidence are higher amongst girls than boys and nutrition knowledge decreases with increasing social deprivation.

The research was funded by the Department of Health. The views expressed are the authors' own.

National Food Alliance (1997) Myths about food and low income. London: National Food Alliance
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12.17 The effect of an after school 'Club' on intake of foods and nutrients by children from deprived social backgrounds

The effect of an after school 'Food Club' on intake of foods and nutrients by children from deprived social backgrounds. By S A Revill[1], A J Adamson[1] R Stacy[1], J Hooper, D Walshaw[2] and P. J. Moynihan, [1]*Human Nutrition Research Centre, and* [2] *Department of Mathematics and Statistics, University of Newcastle NE1 4LP*

A barrier to achieving a healthy diet may be the inability or lack of confidence to prepare healthy inexpensive foods (National Food Alliance 1997). Possession of cooking skills is one of the factors most likely to indicate better diets in low-income families (Dowler and Calvert 1994).

The objective of this controlled dietary intervention was to measure the effects of an after school Food Club, which aimed to teach children from deprived social backgrounds how to prepare healthy inexpensive foods, on dietary intakes of fruit, vegetables, starchy foods and nutrients.

One hundred and ninety eight children (100 intervention and 98 control) from year 7 (age 11-12 years) in 10 schools in deprived areas of Tyne and Wear were recruited into the study. Children from 5 schools attended an after school Food Club on one night a week for 20 weeks. Children from the 5 remaining schools served as controls. Diet was assessed using the 2 x 3 day estimated food diary and interview technique (Hackett *et al* 1984). Data were coded using the 5th Edition of McCance and Widdowson's '*The Composition of Foods*' and supplements, and were entered into an Access Database. Intake of nutrients and foods belonging to the five food groups of the National Food Guide (Health Education Authority 1994) were derived using purpose-written programmes. Changes within groups were determined using paired t-test and differences between groups for changes in intakes of foods and nutrients were determined using t-test. Secondary analyses were carried out by sex. Eighty-four children in the intervention group (31 boys and 53 girls) and 88 children in the control group (34 boys and 54 girls) completed all food diaries. The results are tabulated below.

	Intervention group						Control group					
	T0		T1		T1-T0		T0		T1		T1-T0	
	Mean	SD	mean	SD	mean	S.E	mean	SD	mean	SD	mean	S.E
Energy MJ	8.8.	2.1	9.2	2.5	0.5	0.3	8.6	2.0	9.3	2.3	0.8**	0.3
% energy Fat	36.3	3.5	36.3	3.7	0.3	0.4	35.4	4.0	35.9	3.7	0.5	0.5
% energy Saturated fat	12.1	1.9	12.4	2.0	0.4	0.3	11.6	2.3	11.9	2.0	0.2	0.3
% energy total sugar	21.8	4.2	20.1	4.7	-1.6*	0.6	23.2	5.5	20.8	4.3	-2.4*	0.6
% energy NME sugar	16.8	4.0	14.9	4.5	-1.6	0.6*	18.1	5.1	15.3	3.8	-2.7*	0.7
% energy starch	28.2	3.7	29.5	4.3	1.0	0.5**	28.2	4.0	29.5	3.8	1.4*	0.5
Fruit & vegetables (g/d)	129	94	154	98	19.2	13.6	147	101	169	99	20.4	12.9
Starchy foods (g/d)	326	90	369	109	51.1*	15.2	295	77	377	203	83.9*	10.6

* $P<0.01$ ** $P<0.05$ – paired t-test.

The results show that both intervention and control groups significantly increased intake of starch and starchy foods, and reduced their intake of sugars. However, no significant differences in changes in intake of these nutrients or foods were observed between groups. Analysis by sex showed boys in the intervention group significantly increased their intake of fruit and vegetables by 75 g/d (P=0.003), whereas boys in control group and girls in both groups showed no significant change in intake of fruit and vegetables. The food club had a positive impact on fruit and vegetable intake of boys but as other positive dietary changes were observed for both groups these may not be attributed to attendance at the Food club.

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